U.S. Department of Interior
Bureau of Land Management
Colorado Southwest District
Tres Rios Field Office

U.S. Department of Agriculture
U.S. Forest Service – Region 2
San Juan National Forest

September 2013

Volume I:
Final Environmental Impact Statement

BLM Tres Rios Field Office
San Juan National Forest
Land and Resource Management Plan

FINAL ENVIRONMENTAL IMPACT STATEMENT
for the
Final San Juan National Forest
and Proposed Tres Rios Field Office
Land and Resource Management Plan

Archuleta, Conejos, Dolores, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Rio Grande, San Juan, San Miguel Counties, Colorado

Lead Agencies:	USDA Forest Service USDI Bureau of Land Management
Cooperating Agencies:	Town of Rico, Colorado
Responsible Officials:	Helen Hankins, State Director Bureau of Land Management Colorado State Office 2850 Youngfield St. Lakewood, CO 80215 Daniel Jiron, Regional Forester USDA Forest Service, Rocky Mountain Region 740 Simms St. Golden, CO 80401
For Information, Contact:	Mark B. Lambert Staff Officer, Planning and Public Service (970-385-1240)
Access Document Online:	http://www.fs.usda.gov/goto/sanjuan/planning or http://www.blm.gov/co/st/en/fo/sjplc/land_use_planning.html

Cover Photo: The U.S. Forest Service San Juan National Forest and the Bureau of Land Management Tres Rios Field Office manage about 2.5 million acres of public lands in southwest Colorado. This photograph, taken from the Molas Pass Overlook near Silverton, includes Molas Lake and Kendall Peak, both managed by the Tres Rios Field Office, and high peaks of the San Juan National Forest's portion of the Weminuche wilderness, the largest designated wilderness in Colorado.

United States Department of Agriculture
Forest Service
San Juan National Forest
Durango, CO 81301

United States Department of the Interior
Bureau of Land Management
Tres Rios Field Office
Dolores, CO 81323

In Reply Refer To:
BLM: 1610 (CO-933)
USFS: 1920

Dear Reader:

Enclosed is the Final San Juan National Forest and Proposed Tres Rios Field Office Land and Resource Management Plan (together referred to as the LRMP) and Final Environmental Impact Statement (FEIS). The Bureau of Land Management (BLM) and U.S. Forest Service (USFS) have prepared the LRMP and FEIS jointly and in consultation with cooperating agencies, taking into account public comments received during this planning effort. The LRMP provides a framework for the future management direction and appropriate use of lands administered by the Tres Rios Field Office and San Juan National Forest, located in Archuleta, Conejos, Dolores, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Rio Grande, San Juan, and San Miguel counties, Colorado. The document contains land use planning decisions to guide the BLM's management of lands within the Tres Rios Field Office and USFS's management of the San Juan National Forest.

This LRMP and FEIS have been developed in accordance with the National Environmental Policy Act of 1969, as amended; the Federal Land Policy and Management Act of 1976, as amended; and the National Forest Management Act of 1976, as amended. For the BLM, the LRMP is largely based on Alternative B, the Preferred Alternative in the Draft LRMP and Environmental Impact Statement (EIS), which was released on December 14, 2007, and further analyzed through a Supplement to the Draft EIS that was released on August 26, 2011. The LRMP and FEIS contain the BLM's proposed plan. For the USFS, the LRMP is largely based on Alternative B, the Preferred Alternative in the Draft LRMP/EIS, and further analyzed through the Supplement to the Draft EIS. The LRMP and FEIS contain the USFS's selected alternative (also referred to as the Final LRMP). The LRMP/FEIS contains a summary of changes made between the Draft LRMP/EIS and the enclosed LRMP/FEIS, impacts of the LRMP, a summary of the written and verbal comments received during the public review periods, and responses to the comments.

Administrative Review Process

Both the BLM and the USFS have an administrative review process. For those with eligibility to participate in the agency-specific administrative review process, each process is described below. When filing a BLM protest or USFS appeal, please be sure to address agency-specific issues with the relevant agency (e.g., issues only relating to the USFS or the San Juan National Forest will not be addressed through a BLM protest response—the same goes for BLM-specific issues received through an appeal to the USFS). Refer to the contact information at the end of this letter if you have questions about filing properly.

United States Department of Agriculture **Forest Service** **San Juan National Forest** **Durango, CO 81301**	**United States Department of the Interior** **Bureau of Land Management** **Tres Rios Field Office** **Dolores, CO 81323**

Bureau of Land Management Protest Process

Pursuant to the BLM's planning regulations at 43 CFR 1610.5-2, any person who participated in the planning process for this LRMP and has an interest that is or may be adversely affected by the planning decisions may protest approval of the planning decisions within 30 days from date the U.S. Environmental Protection Agency (EPA) publishes the Notice of Availability in the *Federal Register.* For further information on filing a protest, please see the accompanying protest regulations in the pages that follow (labeled as Attachment # 1). The regulations specify the required elements of your protest. Take care to document all relevant facts. As much as possible, reference or cite the planning documents or available planning records (e.g., meeting minutes or summaries, correspondence, etc.).

Emailed protests will not be accepted as valid protests unless the protesting party also provides the original letter by either regular or overnight mail postmarked by the close of the protest period. Under these conditions, the BLM will consider the emailed protest as an advance copy and will afford it full consideration. If you wish to provide the BLM with such advance notification, please direct emailed protests to Brenda_Hudgens-Williams@blm.gov.

All protests, including the follow-up letter to emails must be in writing and mailed to one of the following addresses:

Regular Mail:	**Overnight Mail:**
Director (210) Attn: Brenda Hudgens-Williams P.O. Box 71383 Washington, D.C. 20024-1383	Director (210) Attn: Brenda Hudgens-Williams 20 M Street SE, Room 2134LM Washington, D.C. 20003

Before including your address, phone number, email address, or other personal identifying information in your protest, be advised that your entire protest—including your personal identifying information—may be made publicly available at any time. While you can ask us in your protest to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

The BLM Director will make every attempt to promptly render a decision on each protest. The decision will be in writing and will be sent to the protesting party by certified mail, return receipt requested. The decision of the BLM Director shall be the final decision of the U.S. Department of the Interior on each protest. Responses to protest issues will be compiled and formalized in a Director's Protest Resolution Report made available following issuance of the decisions.

Upon resolution of all land use plan protests, the BLM will issue an approved LRMP and Record of Decision (ROD). The approved LRMP and ROD will be mailed or made available electronically to all who participated in the planning process and will be available to all parties on the BLM website http://www.blm.gov/planning.

Unlike land use planning decisions, implementation decisions included in this LRMP/FEIS are not subject to protest under the BLM planning regulations, but are subject to an administrative review process, through appeals to the Office of Hearings and Appeals, Interior Board of Land Appeals pursuant to 43 CFR, Part 4 Subpart E. Implementation decisions generally constitute the BLM's final approval allowing on-the-ground actions to proceed. Where implementation decisions are made as part of the land use planning process, they are still subject to the appeals process or other administrative review as prescribed by specific resource program regulations once the BLM resolves the protests to land use planning decisions and issues an approved LRMP and ROD. The approved LRMP and ROD will therefore identify the implementation decisions made in the LRMP that may be appealed to the Office of Hearing and Appeals.

U.S. Forest Service Appeal Process

There are two USFS decisions being made: 1) a decision on a Final LRMP and 2) a final decision on oil and gas leasing availability. Each decision has a separate appeal process.

Final LRMP Decision: The LRMP decision is in accordance with the transition provisions of the current USFS planning regulations (36 CFR 219.17(b)(3)) that permit use of a previous 1982 version for the purpose of revising the LRMP. Under the transition provisions, the LRMP decision is subject to appeal under the "optional appeal procedures" (the former 36 CFR 217 appeal procedures that were in effect prior to November 9, 2000) available for review at:
http://www.fs.fed.us/emc/applit/includes/PlanAppealProceduresDuringTransition.pdf

Appeals may be submitted electronically or mailed to the Chief of the Forest Service. Appeals should be emailed or postmarked within 90 days after the date the legal notice of this decision is published in the newspaper of record, *The Denver Post*. The appeal must clearly state that it is a Notice of Appeal of the San Juan National Forest LRMP decision pursuant to the Optional Appeal Procedures. Appeals must meet the content requirements of Section 9 of the Optional Appeal Procedures.

Appeals may be mailed electronically in a common digital format to: appeals-chief@fs.fed.us. A written notice of appeal must be filed in duplicate with the Chief of the Forest Service at:

USDA Forest Service
Attn: Judicial and Administrative Reviews
EMC, RPC-6
1601 N. Kent St.
Arlington, VA 22209

Requests to stay the approval of this revised San Juan National Forest LRMP will not be granted (Section 10 of the Optional Appeal Procedures). For additional information concerning this decision or the USFS appeal process contact: Forest Supervisor, San Juan National Forest, 15 Burnett Court, Durango, CO 81301 or phone (970) 385-1290.

Final Oil and Gas Leasing Availability Decision: The separate USFS oil and gas leasing availability decision is being made pursuant to 36 CFR 215. Appeals must meet the content requirements of 36 CFR 215.14. Only individuals or organizations who submitted comments or otherwise expressed interest in the project during the comment period may appeal. Appeals must be postmarked or received by the Appeal Deciding Officer within 45 days of the publication of the notice in *The Durango Herald*. This date is the exclusive means for calculating the time to file an appeal. Timeframe information from other sources should not be relied on. Incorporation of documents by reference is not allowed. The Appeal Deciding Officer is the Regional Forester. Appeals must be sent to: Appeal Deciding Officer, Rocky Mountain Region USFS, 740 Simms St., Golden, CO 80401; by fax to 303-275-5134; or by email to appeals-rocky-mountain-regional-office@fs.fed.us. Emailed appeals must be submitted in rich text (.rtf), MS Word (.doc), or portable document format (.pdf) and must include the project name in the subject line. Appeals may also be hand delivered to the above address during regular business hours of 8:00 a.m. to 4:30 p.m. Monday through Friday.

If you have any questions, please contact Mark Lambert, Planning Staff Officer, at 15 Burnett Court, Durango, CO 81301 or by phone at (970) 385-1240.

Sincerely,

DANIEL J. JIRON
Regional Forester, Rocky Mountain Region
U.S. Forest Service

Helen M Hankins

HELEN M. HANKINS
Colorado State Director,
Bureau of Land Management

Enclosure

Protest Regulations

[CITE: 43CFR1610.5-2]

TITLE 43--PUBLIC LANDS: INTERIOR
CHAPTER II--BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR
PART 1600--PLANNING, PROGRAMMING, BUDGETING--Table of Contents
Subpart 1610--Resource Management Planning
Sec. 1610.5-2 Protest procedures.

(a) Any person who participated in the planning process and has an interest which is or may be adversely affected by the approval or amendment of a resource management plan may protest such approval or amendment. A protest may raise only those issues which were submitted for the record during the planning process.

(1) The protest shall be in writing and shall be filed with the Director. The protest shall be filed within 30 days of the date the Environmental Protection Agency published the notice of receipt of the final environmental impact statement containing the plan or amendment in the Federal Register. For an amendment not requiring the preparation of an environmental impact statement, the protest shall be filed within 30 days of the publication of the notice of its effective date.

(2) The protest shall contain:

(i) The name, mailing address, telephone number and interest of the person filing the protest;
(ii) A statement of the issue or issues being protested;
(iii) A statement of the part or parts of the plan or amendment being protested;
(iv) A copy of all documents addressing the issue or issues that were submitted during the planning process by the protesting party or an indication of the date the issue or issues were discussed for the record; and
(v) A concise statement explaining why the State Director's decision is believed to be wrong.

(3) The Director shall promptly render a decision on the protest.

(b) The decision shall be in writing and shall set forth the reasons for the decision. The decision shall be sent to the protesting party by certified mail, return receipt requested. The decision of the Director shall be the final decision of the Department of the Interior.

Executive Summary

Introduction

In accordance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] 4321 et seq.), the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976, (NFMA) (Sec. 6, 16 USC 1600.), and the Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1701 et seq.), the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS), in cooperation under a “Service First” partnership, have prepared a Final San Juan National Forest and Proposed Tres Rios Field Office Land and Resource Management Plan (LRMP) and Final Environmental Impact Statement (FEIS) for the public lands in southwest Colorado within their respective jurisdictions.

The purpose, or goal, in developing this LRMP and FEIS is to ensure that National Forest Service (NFS) and BLM-administered lands, resources, and mineral estate are managed in accordance with applicable laws, as well as with the principles of multiple use and sustained yield. The public lands in this administrative area, although under the care and management of the USFS and the BLM, belong to the American people; thus, it is the overriding goal of these agencies to actively seek out, engage, and include the public, and all other interested parties, in this planning process—a process that could shape how visitors perceive, experience, use, and enjoy their public lands.

The Planning Area

The planning area is located in southwest Colorado in Archuleta, Conejos, Dolores, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Rio Grande, San Juan, and San Miguel Counties. The western border of the planning area is the Utah/Colorado state line. The southern border of the planning area is the New Mexico/Colorado state line. The eastern border is the Continental Divide. The northern border is the administrative boundaries of the Rio Grande, Gunnison, Grand Mesa, and Uncompahgre National Forests, and the BLM Uncompahgre and Gunnison Field Offices. This LRMP provides a framework to guide future management decisions on approximately 1,867,800 acres of the San Juan National Forest (SJNF), administered by the USFS, and approximately 500,000 surface acres and 300,000 acres of subsurface mineral estate administered by the BLM.

The Existing Bureau of Land Management/U.S. Forest Service Land Management Plans

The SJNF is currently being managed under the following land use plans:

The San Juan/San Miguel Resource Management Plan (BLM 1985): The current San Juan/San Miguel Resource Management Plan provides management direction for lands within the Tres Rios Field Office (TRFO), with the exception of those lands within the Canyons of the Ancients National Monument, which are managed under the Canyons of the Ancients Resource Management Plan (BLM 2010a).

The San Juan National Forest Land and Resource Management Plan (USFS 1983): The current San Juan National Forest Land and Resource Management Plan was approved in 1983, with a major amendment in 1992 and 22 additional amendments. The LRMP and FEIS have been prepared using the provisions of the 1982 planning rule (36 Code of Federal Regulations [CFR] 219), as provided by the 2004 interpretative rule that clarified the transition provisions of the planning rule adopted on November 9, 2000. The current 1983 plan provides direction for the SJNF including its three Ranger Districts: Dolores, Columbine, and Pagosa.

SJNF lands are currently managed for oil and gas leasing under the analysis and decision for the 1983 San Juan National Forest Land and Resource Management Plan. Under that plan, 1,367,769 acres were open for leasing, mostly under standard lease terms. Approximately 95,500 acres are currently leased.

Management Alternative Goals and Objectives

Four land management alternatives, and their associated environmental impacts and related issues, are described and analyzed in this document. Additionally, oil and gas leasing availability alternatives for NFS lands, including the No Lease Alternative, are described and analyzed. The alternatives reflect a reasonable range of potential management actions, based on the Analysis of the Management Situation; federal, state, local, and other governmental agency input and consultation; Native American tribal agency input and consultation; and public scoping. The alternatives in LRMP and FEIS seek to fully address the changing needs of the planning area, with the goal of selecting a management strategy that best achieves an effective combination of management actions, including one that:

- Addresses all of the BLM-administered lands and NFS lands and resources administered by the SJNF and TRFO (exclusive of Canyons of the Ancients National Monument);
- Employs a community-based planning approach that complies with all applicable local, state, federal, and Native American tribal laws, standards, policies, and implementation plans, as well as with all BLM and USFS polices, guidelines, and regulations;
- Recognizes all valid existing rights;
- Complies with FLPMA, the NFMA, NEPA, and all other applicable laws, rules, regulations, standards, policies, and guidelines;
- Coordinates and consults with Native American tribes in order to identify sites, areas, and/or objects important to their cultural and religious heritages;
- Identifies management actions and allowable uses anticipated to achieve the established goals and objectives, and to reach the desired outcomes;
- Provides comprehensive management direction by serving as a basis for land use decisions for all appropriate resources and resource uses administered by the SJNF and TRFO;
- Establishes goals and objectives (desired outcomes) for managing resources and resource values according to the principles of multiple use and sustained yield;
- Identifies land use planning decisions that will serve to guide future land management actions and subsequent site-specific implementation decisions;
- Considers current scientific information, research, new technologies, and the results of relevant resource assessments, monitoring, and coordination;
- Considers current and potential future uses of the public lands and resources administered by the SJNF and TRFO through the development of reasonable foreseeable future developments and activity scenarios based on historical, existing, and projected levels of use;
- Recognizes the nation’s needs for domestic sources of minerals, food, timber, and fiber, and incorporates the requirements of the Energy Policy and Conservation Act Reauthorization, the Energy Policy Act, the National Fire Plan, the Healthy Forests Restoration Act, and the Healthy Forests Initiative;
- Retains flexibility so that the USFS and BLM can adapt to new and emerging issues and opportunities, and provide for adjustments to decisions over time, based on new information and monitoring; and
- Strives to be compatible with existing plans and policies of adjacent local, state, federal, and Native American tribal agencies, consistent with federal laws, regulations, and BLM and USFS policy.

San Juan National Forest Oil and Gas Leasing

A separate planning-related action analyzed in this FEIS is the identification of SJNF lands that would be administratively available for oil and gas leasing, along with designation of lease stipulations to be applied to future leases (36 CFR 228.102(c) and (d)). BLM makes decisions regarding leasing availability within its plan decisions.

The oil and gas leasing availability decision consists of identifying those areas of NFS lands that would be:

- Open to leasing, subject to the terms and conditions of the standard oil and gas lease form (including an explanation of the typical standards and objectives to be enforced under the standard lease terms);
- Open to leasing, subject to lease stipulations, such as prohibiting surface use on areas larger than 40 acres, or such other standards that may be developed for stipulation use (with discussion as to why the constraints are necessary and justifiable); or
- Closed to leasing, with distinction made between those areas that are closed through exercise of management direction and those closed by law or regulation.

Public Involvement

NEPA requires that federal agencies hold an open and early process for determining the scope of issues to be addressed in order to identify the significant issues that could be associated with the Proposed Action. The term “scope” is defined as the range of actions, alternatives, and impacts to be considered during NEPA analysis.

On September 23, 1999, a Notice of Intent to revise the USFS Land Management Plan for the San Juan National Forest was published in the Federal Register. On December 14, 2004, a second Notice of Intent was published, updating timelines and informing all interested parties that the BLM Resource Management Plan would be revised concurrently.

The SJNF and TRFO conducted a broad community-based public scoping process. This scoping process included the following opportunities for public participation:

- Study groups
- Public meetings
- Facilitated discussion groups
- Recreation interviews
- Aspen workshop
- Written comments

Cooperating agency status was offered to approximately 30 federal and state agencies, and cities and county governments. In addition to offering cooperating agency status, local city, town, and county governments were encouraged to attend study groups, attend public meetings, and provide comments. The two tribes with adjacency to the SJNF were invited to be cooperators: Southern Ute Indian Tribe and Ute Mountain Ute Tribe. The 26 tribes affiliated with the SJNF and TRFO were also informed and provided opportunities to participate in the revision process.

The main topic areas addressed in this FEIS were identified based on input from interagency consultation, other federal agencies, state and local government, tribes, cooperating agencies, internal review, the public, industry representatives, and special interest groups. The issues represent the challenges that exist with current management, BLM and USFS plans, and USFS oil and gas leasing availability decision. The SJNF and TRFO have documented each of the issues in a scoping

report and identified the following main planning issues that were analyzed and documented in the FEIS.

Issues

Planning issues identify demands, concerns, and/or conflicts regarding the use or management of public lands and resources. These issues typically express potential impacts on land and on resource values. The main topic areas addressed in the LRMP/FEIS were identified based on input from interagency consultation, state government, cooperating agencies, internal review, and input from the public, industry representatives, and special interest groups. The public scoping process included invitations to interested parties to comment on, and contribute input with regard to, the planning process.

Four main issues drove the development of alternatives for the LRMP/FEIS. The alternatives reflect where people had notably different ideas about how to manage and/or use different areas administered by the TRFO and SJNF. These different ideas came from the community study groups, web-based interaction, scoping meetings, written comments, and other scoping activities. These issues include the following:

- ***Issue One - Balancing Management between the Ideas of Maintaining “Working Forests and Rangelands” and Retaining “Core Undeveloped Lands”***

When people discussed maintaining a “working forest,” the emphasis included respecting valid and existing rights to resources, retaining access and commodity production activities that are important to the economy of local communities, and continuing historical uses in areas where access and infrastructure investments have already been made.

The desires expressed by the people who discussed retaining “core undeveloped areas” included retaining areas that have not been developed in order to provide high-quality wildlife habitat and corridors, minimize ecosystem fragmentation, and support natural ecosystem functions.

- ***Issue 2: Providing Recreation and Travel Management within a Sustainable Ecological Framework***

Discussions at community meetings often included the need to find a balance between the way long-time residents, new arrivals, and visitors use the public lands. There was also much discussion on achieving a balance between areas where motorized recreation would be allowed and where non-motorized forms of travel and recreation would dominate. Opinions were divided on the appropriate mix of different types of recreation settings and opportunities that should be provided on public lands.

- ***Issue 3: Management of Special Area Designations and Unique Landscapes***

A number of unique and special areas were identified during the scoping process as meriting special attention. The importance of maintaining scenic views and recreation opportunities along important travel routes, such as along the San Juan Skyway, the Alpine Loop Backcountry Byway, the Continental Divide Trail, and the Colorado Trail, were common to all interests and area represented across the alternatives. Suitability of roadless areas of the SJNF for inclusion in the National Wilderness Preservation System and the suitability of rivers and streams on both SJNF and TRFO lands for inclusion in the National Wild and Scenic Rivers System are examined and analyzed in alternatives.

- ***Issue 4: Management of Oil and Gas Leasing and Development***

People expressed concerns regarding both where and how development might occur. Community participants noted that LRMP decisions and oil and gas leasing availability decisions need to be coordinated so that the infrastructure needs (roads, well pads, and pipelines) for oil and gas development are compatible with desired conditions for specific areas of land. Comments mostly related to whether new road construction should occur in areas that are currently undeveloped.

The Draft Environmental Impact Statement (EIS) was published and made available to the public for comments in December 2007. During the 120-day comment period, there were over 18,000 letters received. Due, in part, to the comments and interest received on the Draft EIS, the Reasonably Foreseeable Development (RFD) scenario was revised to include development projections from the Gothic Shale Gas Play and a new air quality model was completed based on the updated development projections. The results were documented in a Supplement to the Draft EIS published August 26, 2011. An additional 90 days was provided for the public to comment of the new information and there were four open house meetings located in cities across the planning area. All comments and a response to comments are contained in the project record and summarized in Appendix S.

Alternatives

Alternative A represents the continuation of current management direction under the existing BLM and USFS land management plans: the BLM's San Juan/San Miguel Resource Management Plan (1985) and the San Juan National Forest Land and Resource Management Plan (1983), both as amended. Alternative A meets the NEPA requirements that a No Action Alternative be considered (40 CFR 1502.14). "No Action" means that the alternative reflects the implementation of existing management goals, objectives, and management practices based on the existing land use plans. Alternative A also serves as the baseline for comparing and contrasting the impacts of the other alternatives. Alternative A is based on reasonably foreseeable actions, existing planning decisions and policies, and existing land use allocations and programs.

Alternative B (Preferred Alternative) focuses on balancing the goals of maintaining "working forest and rangelands" and of retaining "core, undeveloped lands" and providing and maintain the full diversity of uses and active recreation opportunities. Uses and activities that require roads, such as timber harvesting and oil and gas development, would be mostly focused in areas that already have roads, while the relatively undeveloped areas and areas that currently do not have roads would, for the most part, remain that way. Alternative B was developed to respond to the major issues while providing for common ground among conflicting opinions and multiple uses of public lands in a sustainable fashion. Alternative B also incorporates the goals of the USFS's Strategic Plan (36 CFR 219.12(f)(6)) and the Department of the Interior's Strategic Plan. The Responsible Officials, the Regional Forester for NFS lands and the State Director for BLM lands, have identified Alternative B as the Preferred Alternative in this FEIS.

Alternative C provides for a mix of multiple-use activities with a primary emphasis on maintaining the undeveloped character of the planning area. Production of goods from vegetation management would continue, but might be secondary to other non-commodity objectives. Under Alternative C, production of goods and services would be more constrained than that proposed under Alternatives A, B, and D. Alternative C identifies more resources and areas for special designation than the other alternatives and overall emphasizes the undeveloped areas and non-motorized recreational activities to a greater degree than any of the other alternatives.

Alternative D provides for a mix of multiple-use activities, with a primary emphasis on the "working forest and rangelands" in order to produce a higher level of commodity goods and services when compared to the other alternatives. Alternative D allocates the least amount of land for special designation. Under Alternative D production of goods and services would be greater than that proposed under Alternatives B and C.

Affected Environment and Environmental Consequences

This FEIS is a programmatic document. It discusses environmental effects on a broad scale and does not predict what will happen when such broad-based standards and guidelines are implemented on individual, site-specific projects, nor does it convey the long-term environmental consequences of any site-specific project. The analysis includes potential effects of managing the lands within the SJNF and TRFO under certain standards, guidelines, and management area prescriptions and does not include site-specific project analysis. In addition to the land use planning analysis, the SJNF is analyzing the programmatic effects of NFS lands that would be administratively available for oil and gas leasing.

The affected environment has been identified as the NFS and BLM-administered public lands (excluding the Canyons of the Ancients National Monument) and the applicable resources within the SJNF and TRFO.

The direct, indirect, and cumulative effects of the Proposed Action and each of the alternatives have been disclosed in the programmatic analysis contained in Chapter 3 of the FEIS. The alternatives represent variations in management emphasis; for example, one alternative may emphasize outputs and opportunities for development, while another may emphasize protection of specific resources or conditions. The effects of the different alternatives would vary depending on the resource being affected.

The resources considered and analyzed were organized into the following categories.

Terrestrial Ecosystems
Several ecosystem types have been identified and considered in the analysis: spruce-fir forests, aspen forests, cool-moist mixed conifer forests, warm-dry mixed conifer forests, ponderosa pine forests, pinyon-juniper woodlands, mountain shrublands, mountain grasslands, sagebrush shrublands, semi-desert shrublands, and alpine terrestrial ecosystems.

Terrestrial Wildlife
Terrestrial wildlife has been divided into five main species/habitat types: amphibians and reptiles; migratory birds; mammals; threatened, endangered, candidate, and proposed species and habitat (as identified pursuant to the Endangered Species Act); and sensitive species.

Riparian Areas and Wetland Ecosystems
The common definition used throughout the planning process for riparian areas is an area seasonally saturated or inundated at a frequency and duration sufficient to produce vegetation typically adapted for life in saturated soil conditions. It is also the transitional area between permanently saturated wetlands and upland areas often referred to as a riparian area. Riparian areas and wetland ecosystems are important because they store water, enhance water quality, provide habitat for wildlife and plants, and provide recreation and aesthetic values. Although they are small in extent (it is estimated they comprise less than 5% of the SJNF and TRFO land area), they represent a very important ecological component of the SJNF and TRFO.

Aquatic Ecosystems and Fisheries

The waters of the planning area support a variety of ecosystems. In southwest Colorado, these aquatic communities and ecosystems can be found at many different elevations and within many different habitats. In general, the most common aquatic biota within the planning area can be categorized as fishes, aquatic plants, aquatic insects, and the embryonic and larval stages of amphibian.

Water Resources

The importance of water protection was evident in the wording of the Organic Act of 1897, the legislation that founded the USFS, which stated that “no public forest reservation shall be established, except to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flows.” Public lands within the planning area, especially NFS lands, contain a large and important source of clean water for this nation. Watersheds throughout the planning area, as administered by both agencies, provide a multitude of benefits, including for aquatic and riparian habitat, municipal water supplies, flood reduction, low-flow augmentation, and recreation opportunities, as well as for providing a continuous supply of clean water for many additional uses.

Livestock and Range Management

Domestic livestock grazing has occurred on public lands within the planning area since the late 1870s. The livestock industry, comprising mostly ranching families, has been an integral part of community development, as well as overall lifestyle, in southwest Colorado. Public lands supply winter, spring, and summer grazing for dependent livestock producers and represent a significant portion of their total operations. Generally, term grazing permits are issued for 10 years to qualified producers, allowing grazing on designated areas, or allotments. Permit holders or grazing permittees pay an annual fee for the privilege of using public land forage. They are also required to abide by the terms and conditions of the grazing permit. These terms and conditions address livestock and land ownership, range improvement construction and maintenance, and required livestock management practices.

Invasive Species

Invasive species (noxious plants and aquatic nuisance species) can impact water quality, wildlife habitat, fisheries, forage production, and soil productivity. Invasive species can also displace native species. Noxious weeds and other invasive plant species establish as a result of ground disturbance and where a seed source is present. Weeds are introduced and spread in many ways, including by people, wildlife, vehicles, wind, water, and fire). The LRMP contains desired conditions, objectives, standards, and guidelines necessary to implement an integrated invasive species management program. Invasive species move across jurisdictional boundaries and property lines; therefore, implementation of the LRMP would involve close coordination and partnerships with local, state, tribal, and federal agencies, as well as with interested organizations and individuals.

Timber and Other Forest Products

Identification of lands suitable for timber production is one of the key elements of forest plans and delineates where timber production may occur on forest lands. Timber harvests may also occur on other lands. “Other lands” is a classification regarding lands where commercial timber production is not compatible with desired conditions and objectives, but that are physically capable and administratively available for purposes other than the production of wood fiber (including hazardous fuels reduction, ecosystem restoration, visuals, scenic vistas habitat improvement, or other purposes). Lands not suitable for timber harvest, due to various physical and administrative factors, (including slope, soil characteristics, productivity, and/or administrative withdrawals) are also identified within the LRMP.

Multiple scales are considered in timber management on NFS lands. The current conditions and future trends in relation to timber resources and harvesting activity on SJNF lands were evaluated at the forest and geographic area scale.

Special forest products are products or natural resources that are not the traditional timber and fiber products, like sawtimber or houselogs. Special forest products are permitted (or contracted) for removal from public lands (USFS or BLM) for commercial, personal, Native American tribal, educational, and/or scientific purposes (Forest Service Handbook 2409.18_80-2002).

Insects and Disease

Insects and diseases (which tend to be species-specific and often attack plants that have been weakened by other disturbances such as drought) affect tree growth, fire potential, nutrient cycling, and the composition and structure of vegetation communities (Schmid and Mata 1996). At endemic levels, native insects have little impact on forest structure. At epidemic levels, insects can cause tree mortality across whole landscapes. Diseases, which often weaken trees, making them more susceptible to bark beetle attack, generally increase gradually or remain at similar levels over time. Defoliators, such as western spruce budworm (*Choristoneura occidentalis*) can cause substantial damage when favorable moisture and stand conditions result in abundant host habitat.

Fire and Fuels Management

Over the past 10 years, the national emphasis on fire and fuels management has increased as a result of large fires, droughts, increasing forest health concerns, and impacts on communities. New policies and laws incorporated in the LRMP alternatives would provide direction to manage wildfires more effectively, reduce hazardous fuels (especially in wildland urban interface areas), restore and maintain fire-dependent ecosystems, and promote collaboration with local communities in order to address wildfire-related issues.

Air Quality

Under FLPMA and the Clean Air Act, the BLM and USFS cannot conduct or authorize any activity that does not conform to all applicable local, county, state, Native American tribal, and other federal air quality laws, statutes, regulations, standards, and implementation plans. Therefore, an air quality effects analysis based on atmospheric dispersion modeling was conducted to analyze potential air quality impacts.

In comparison to oil and gas drilling and production, other management actions on the SJNF considered throughout this analysis are expected to result in minor and/or short duration impacts to air quality. Potential smoke impacts associated with fuels treatments would be analyzed at the project level. Prescribed burning must comply with all applicable air quality standards and with burn permits issued by the State of Colorado. The modeled impacts in the analysis assess the maximum reasonable scenario for oil and gas development over a 15-year period as characterized in the RFD scenario.

Access and Travel Management

Travel is associated with many of the activities that take place within the planning area. Both motorized and non-motorized access are important for providing outdoor recreation, managing wildfire, managing livestock and wildlife, developing natural resources (including timber and minerals), gathering fuel wood, accessing private in-holdings, maintaining electronic sites and utility corridors, and managing and monitoring the planning area.

The Access and Travel Management section of this document provides information about the SJNF and TRFO transportation systems. It includes a description of the management framework relevant to

each agency, a description of the current transportation system and corresponding issues and describes how aspects of the LRMP will aid in addressing the known issues. Finally, it provides an analysis of the direct, indirect, and cumulative impacts related to each of the alternatives as they relate to access and travel management and its interaction with several key public lands ongoing management activities.

Recreation

Population growth, new recreation technology, and community interest have increased the focus on management of outdoor recreation settings and opportunities. Strategies incorporated into the various LRMP alternatives aim to maintain and enhance desirable recreation settings, integrate recreation with other resource objectives, provide for sustainable recreation experiences, and promote collaboration with local and regional partners in order to achieve recreation objectives.

Scenery and Visual Resource Management

Private development and population continue to increase within the planning area, as do the demands on area resources. Concerns about retention of the area's outstanding scenic quality are at the forefront of public interest within the planning area. Visitors and residents alike place a high value on the protection of intact natural and cultural landscapes. The economic and lifestyle benefits of high-quality scenery are primary contributors to the wealth of the region.

Heritage and Cultural Resources

The planning area is situated in the heart of an area with a long and rich prehistoric and historic record. Native American occupation of the area dates back approximately 10,000 years. The archaeological record contains some of the earliest agricultural societies in the region. The historic period brought Spanish and Euro-American explorers, trappers, miners, and settlers into the region. This long record of human occupation has left one of the highest densities of prehistoric and historic heritage and cultural resources to be found in the United States. These sites have national, international, and Native American tribal significance.

Heritage and cultural resources are non-renewable resources that include historic and prehistoric artifacts, structures, sites, districts, and archival materials important for their scientific, educational, economic, and social values. Throughout the region advanced archaeological and historical research is an ongoing endeavor. There is a great public interest in visitation to heritage and cultural resources. This visitation is an integral part of the region's economy. Twenty-six Native American tribes and pueblos claim cultural affiliation with heritage and cultural resources located within the planning area.

Paleontological Resources

The term ''paleontological resource'' means any fossilized remains, traces, or imprints of organisms preserved in or on the earth's crust that are of paleontological interest and that provide information about the history of life on earth, except that the term does not include:

1. Any materials associated with an archaeological resource (as defined in section 3(1) of the Archaeological Resources Protection Act of 1979 (16 USC 470bb(1)); or

2. Any cultural item (as defined in Section 2 of the Native American Graves Protection and Repatriation Act [25 U.S.C. 3001]).

Fossils convey the story of history of life on earth, including the evolution and extinction of marine, freshwater, and terrestrial organisms.

Paleontological (fossil) resources are natural resources that occur on public lands; therefore, they are managed in accordance with the requirements of federal laws, primarily the Paleontological Resources Preservation Act of 2009 and the and NEPA. These laws apply similarly to both BLM and NFS lands, although FLPMA is also applicable to BLM lands. Additional requirements for the collection, preservation, and protection of paleontological resources on applicable federal lands will be addressed in forthcoming federal regulations currently being promulgated

Lands and Special Uses

Special use permits, right-of-way grants, easements, and leases authorize the occupancy and use of BLM and NFS lands by government agencies, private individuals, or companies for a variety of activities, including roads, dams, pipelines, and other private or commercial uses that cannot be accommodated on private land. Annually, the SJNF and TRFO administer more than 1,000 non-recreational land use authorizations.

The land use permit program also authorizes the occupancy of public lands for pipelines, communication lines, power transmission lines, and communication sites. In order to minimize disturbance, agency policy is to collocate such uses where feasible. Utility corridors are formally designated in order to provide for such use. On SJNF lands, corridor management must comply with the objectives of the management areas crossed by these corridors, unless a specific exception is identified. TRFO lands are generally available for consideration of these uses at the project-planning level, except where restricted by area-specific direction or within exclusion areas. Where pipeline, electric distribution line, and/or communication system line use cannot be collocated, individual authorizations are issued.

Minerals and Energy: Fluid Minerals

Oil and gas (natural gas and carbon dioxide) are defined as leasable minerals under federal law and regulation. The BLM has jurisdiction over management of federal oil and gas resources underlying both BLM and NFS lands, as well as those underlying non-federal surface (split estate) lands within the planning area. The BLM and USFS are joint agencies in this analysis under the 2006 Memorandum of Understanding Concerning Oil and Gas Leasing and Operations.

For BLM public lands and federal leasable minerals under non-federal surface lands, the BLM administers all oil and gas leasing and development activity. The BLM analyzes and makes decisions on leasing availability and discloses impacts in a resource management plan and EIS. Under the Federal Onshore Oil and Gas Leasing Reform Act of 1987 and implementing regulations at 36 CFR 228 E, the USFS must analyze and make decisions on oil and gas leasing for federal leasable minerals underlying NFS lands. Once the USFS determines what lands are available for leasing and the BLM has adopted the analysis, the BLM may offer the selected NFS lands for lease consistent with those decisions. The Record of Decision for this LRMP revision will document the leasing program adopted for the SJNF and TRFO for the next 10 to 15 years.

The oil and gas leasing analysis applies to a total of 2.37 million acres of federal mineral estate within a 3-million-acre analysis area, of which 1.65 million acres (outside wilderness and withdrawn areas) have the potential for the occurrence of oil and gas resources. The 0.91 million acres of private mineral estate within the planning area are not included in this oil and gas leasing analysis because the federal government has no leasing authority over privately held minerals regardless of surface ownership. However, surface use guidelines have been developed, other than No Surface Occupancy, that the BLM/USFS and, to the extent possible, would utilize if and when the holder of private mineral estate proposes to occupy federal surface. Surface use must be negotiated with the private mineral owner.

Minerals and Energy: Solid Minerals

Locatable minerals, mineral materials, and solid leasable minerals are all discussed in this section of the FEIS. Solid mineral resources within the SJNF and TRFO have played a significant role in the past and continue to be important today. Current resource estimates indicate valuable reserves within portions of the planning area. Solid minerals activity is most heavily concentrated on BLM lands in the Slick Rock area near Dove Creek and the associated Uravan Mineral Belt area; however, activity also occurs in the Silverton, Rico, and La Plata areas.

The BLM and USFS manage mineral-related activities consistent with multiple-use management principles. The exploration, development, and production of solid minerals resources are integrated with the use, conservation, and protection of other resources. The BLM also manages approximately 264,400 acres of federally owned mineral estate beneath privately held surface called “split estate” land.

Minerals and Energy: Alternative Energy

Public lands have long provided energy resources for both individual and commercial use. The National Energy Policy has laid the legal groundwork for alternative energy projects on public lands; however, little demand has surfaced in relation to the planning area. Nonetheless, this planning effort addresses alternative energy development in order to offer guidance for projects that are proposed on NFS and BLM-administered lands.

Wilderness and Lands with Wilderness Characteristics

The Wilderness Act of 1964 directs the USFS to analyze additional undeveloped and unroaded lands for proposed inclusion in the National Wilderness Preservation System. The USFS inventories potential wilderness by identifying roadless areas of approximately 5,000 acres or larger and/or roadless areas adjacent to existing wilderness areas. There are three tests applied to roadless areas before they are considered for wilderness area recommendations: capability, availability, and need.

The SJNF shares the management on portions of three wilderness areas (Weminuche, South San Juan, and Lizard Head) with two other forests (the Grand Mesa, Uncompahgre, and Gunnison National Forests and the Rio Grande National Forest). The SJNF also manages the Piedra Area, an area congressionally designated for protection of its wilderness character. The BLM has management responsibility for four BLM wilderness study areas (WSAs): the Dolores River Canyon, McKenna Peak, Menefee Mountain, and Weber Mountain. In total, the SJNF and TRFO manage 420,522 acres of congressionally designated wilderness areas, approximately 55,428 acres of WSAs, and the Piedra Area (approximately 62,550 acres).

Wilderness is part of the multiple-use management mission of both the BLM and the USFS. Wilderness provides opportunities for solitude, as well as for primitive and unconfined recreational experiences. Wilderness is also important to the maintenance of species diversity, the protection of threatened and endangered species, and the protection of watersheds, scientific research, and various social values.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act of October 1, 1968, requires the Secretary of the Interior and the Secretary of Agriculture to undertake studies and investigations to determine which additional wild, scenic, and recreational rivers must be evaluated through land use planning. To be eligible, a river must be free-flowing and must possess one or more outstandingly remarkable river values. To be suitable, a decision is made that the identified values should be protected and that adding the river to the national system is the best method for protecting identified values.

With the passage of the Wild and Scenic Rivers Act in 1968, Congress directed the U.S. Department of Agriculture and the U.S. Department of the Interior to prepare studies of selected rivers on the national forests and public lands as potential additions to the National Wild and Scenic Rivers System. Suitability studies were prepared for the Los Pinos, Piedra, and Dolores Rivers. Wild and Scenic River study reports and EISs were completed for these three rivers and submitted to Congress with recommendations for designation for most river segments. All of these studies were completed in partnership with the State of Colorado Department of Natural Resources.

Scenic, Historic, and Backcountry Byways

The National Scenic Byways Program is under the administration of the U.S. Department of Transportation, Federal Highway Administration. Based on one or more archaeological, cultural, historic, natural, recreational, and/or intrinsic scenic qualities, the U.S. Secretary of Transportation recognizes certain roads as America's byways, All-American Roads, or national scenic byways.

The Colorado Scenic and Historic Byways Commission is a statewide partnership intended to provide recreational, educational, and economic benefits to Coloradoans and state visitors. This system of outstanding touring routes in Colorado affords the traveler interpretation and identification of key points of interest while, at the same time, providing for the protection of significant resources.

Scenic and historic byways are designated by the Colorado Scenic and Historic Byways Commission based on their exceptional scenic, historic, cultural, recreational, and natural features.

Backcountry byways are vehicle routes that traverse scenic corridors utilizing secondary or backcountry road systems.

The planning area contains a majority of the 232-mile-long San Juan Skyway, the 65-mile Alpine Loop National Backcountry Byway, and 114 miles of the Trail of the Ancients Scenic Byway.

National Recreation and Scenic Trails and National Historic Trails

The Calico and Highline National Recreation Trails cross the planning area, typically within areas that are managed for semi-primitive recreation opportunities. Neither of these trails are at or near its use capacity at this time.

Acting upon a vision of a 3,100-mile primitive and challenging backcountry trail that would travel from Canada to Mexico along the backbone of America, Congress designated the Continental Divide National Scenic Trail (CDNST) in 1978. A long section of the CDNST crosses the planning area, traversing the spectacular and remote high country of the San Juan Mountains within the Weminuche and South San Juan wilderness areas. From the Weminuche wilderness area, the CDNST travels north onto BLM-administered lands near Silverton, Colorado. Most of this section of the CDNST meanders between the SJNF and the Rio Grande National Forest, necessitating shared management responsibility for many miles of this significant trail.

Within the planning area, most of the Colorado Trail travels within remote backcountry, wilderness areas, and other lightly traveled areas. Issues resulting from conflicts with motor vehicle use are few. The southernmost section of the Colorado Trail near Durango is heavily used by the community for day-use hiking and biking. Some of the Colorado Trail follows the same route as the CDNST. A portion of the Colorado Trail within the planning area follows the Highline Loop National Recreation Trail.

In 2002, Congress formally designated the Old Spanish Trail as the nation's fifteenth National Historic Trail. The "Main Branch" trail route is now under Highway 184, directly in front of the Dolores Public Lands Office. Between 1829 and 1848, the Old Spanish Trail was used by immigrants and traders on

yearly pack-train expeditions between Santa Fe and the Pueblo of Los Angeles (San Gabriel Mission). The trail was used by trappers, travelers, and military expeditions.

Research Natural Areas

Research natural areas (RNAs) are NFS lands that are part of a network of ecological reserves designated in perpetuity for non-manipulative research, education, monitoring, and the preservation of ecological diversity. They are relatively unaltered by past management activities and managed to allow natural ecological processes to proceed with minimum human intervention. They also serve as reference areas for the study of ecological processes, disturbances, and ecological changes. Most management activities are prohibited in RNAs unless they are needed to achieve desired conditions or maintain the features for which the RNA was established. The 10 RNAs (Narraguinnep, Williams Creek, Electra, Grizzly Peak, Hermosa, Hidden Mesas, Martinez Creek, Navajo River, Piedra, and Porphyry Gulch) on the SJNF are protected areas and as such are key components of the sustainable ecosystems strategy.

Areas of Critical Environmental Concern

Areas of Critical Environmental Concern (ACECs) are BLM lands where special management attention is required to prevent irreparable damage to important historic, cultural, or scenic values, as well as fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards (BLM Manual 1613). FLMPA mandates the BLM to give priority to the nomination and designation of ACECs through the development and revision of resource management plans.

The San Juan/San Miguel Resource Management Plan currently contains one ACEC, Mud Springs/Remnant Anasazi Culture. Twenty-three additional areas were nominated for ACEC consideration through the LRMP revision process, primarily selected from potential conservation areas that were developed by the Colorado Natural Heritage Program. A potential conservation area, which often includes both federal and non-federal lands, represents the land needed to support the long-term survival of the rare species or plant communities within it. Twenty-one of the twenty-three sites were further identified as potential ACECs because they met both the relevance and importance criteria described in the BLM manual. After further analysis, two of the areas were recommended for ACEC designation through this planning process: Gypsum Valley and Anasazi Cultural Area (formerly named Mud Springs/Remnant Anasazi Culture).

Economics

Economic consequences of managing the SJNF and TRFO stretch across Colorado, New Mexico, Arizona, and Utah. A five-county area in Colorado that includes Archuleta, Dolores, La Plata, Montezuma, and San Juan Counties is recognized as the most affected region by the management of these public lands and serves as the focus of the economic analysis. San Juan County, New Mexico, is a significant provider of support activities to the oil and gas industry in southwest Colorado and is therefore discussed in the context of minerals management on the SJNF and TRFO. Comprehensive economic data are generally unavailable at the community level; however, interpretations of larger-scale analyses can sometimes be made and offer insights into particular communities.

Demographics

This section first presents a snapshot of demographic conditions and trends in the five counties most substantially containing the planning area: Archuleta, Dolores, La Plata, Montezuma, and San Juan Counties. The section concludes with discussion of the impacts to population potentially occurring under the range of alternatives for the LRMP.

Summary of Changes Made Since the Draft Land and Resource Management Plan and Environmental Impact Statement

This LRMP and FEIS contain changes that have occurred since the publication of the Draft LRMP/EIS resulting from public comments, policy changes, and additional studies or other information. The key changes are described below. Comment responses in Appendix S provide additional details regarding changes made to the LRMP/FEIS. With the exception of the Supplement to the Draft EIS that was published in 2011 to address new oil and gas development projection and the need for a new air quality model (see Section 2.1.2), the BLM and USFS determined that NEPA supplementation, as described at 40 CFR 1502.9, was not necessary based on the changes described below or any other changes that have occurred between Draft and Final EIS. None of these changes were found to present significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

Ecosystem Management: A section titled "Ecological Framework and the Conservation of Species" has been added to the LRMP (Section 2.1) that describes in detail the strategies, concepts, and components that are used in this LRMP to establish an ecological framework for the conservation and management of ecosystems, habitats, and species. This section also addressed in detail USFS requirements to plan for diversity and viability, and includes an explanation about natural disturbances and the agencies' limited ability to manage the effects of natural disturbances

Climate Change: New LRMP components addressing climate change have been added to relevant sections of the LRMP. These new components focus on managing ecosystems to be resilient and resistant to changes and natural disturbances. Appendix G summarizes the SJNF and TRFO climate change strategy and provides a compiled list of LRMP components that address climate change.

Wildlife: The bluebird was replaced by the hairy woodpecker on the Management Indicator Species list for the SJNF based on comments received by the public and further internal review. LRMP components for wildlife have been updated to reflect current species status, and components specific to threatened and endangered species have generally been revised to emphasize guidance from recovery plans for those species. Additional mitigation has been included in the LRMP for reducing conflicts between bighorn sheep and domestic sheep, and a Draft LRMP guideline requiring the agencies to maintain a minimum level of aquatic habitat by identifying the minimum flow rates required to support that habitat has been changed to a standard in the Final LRMP, and four options were provided for meeting the standard.

Water: Groundwater and municipal watershed protections have been added, especially to mitigate potential impacts related to oil and shale gas development.

Rangeland Management and Invasive Species: LRMP components have been developed to mitigate potential impacts to bighorn sheep, and to improve and maintain sagebrush ecosystems. Clarified that allowable use of forage and browse will be determined during subsequent project-level analysis. LRMP components have been developed to address cheat grass, and the Final LRMP provides improved guidance for management of invasive species.

Air Quality: Standards and guidelines were revised to mitigate impacts from oil and gas development activities (these were published for public review and comment in the Supplement to the Draft EIS; additional changes were made based on public comments).

Travel Management: The LRMP/FEIS now identifies the BLM off-highway vehicle designations of closed, limited, and open on all TRFO lands. The Draft LRMP/EIS had applied USFS terminology of

“suitable” and “unsuitable” to BLM lands for both over-ground and oversnow motorized travel decisions. Guidelines addressing route density were revised, including specific guidelines to mitigate potential impacts to watersheds and wildlife; route density guidance is no longer tied to management areas. Definitions for “suitable” and “suitable opportunity” for motorized travel on NFS lands were improved for clarity. Suitability areas were slightly adjusted based on public comment and improved mapping to correspond travel mode with appropriate land designations such as recommended wilderness. For oversnow travel, the suitable area for motorized use near Andrews Lake was extended to go east to the wilderness boundary and south along U.S. Highway 550 to follow terrain, improve manageability, provide a better location for snowmobiles to cross the highway, and provide more suitable snowmobile terrain. In the Corkscrew Gulch/U.S. Basin area, the suitable area was extended south to the Corkscrew Gulch road, providing a link from the suitable terrain east of U.S. Highway 550 to the suitable terrain west of the highway. This and other minor oversnow corridors were created to provide improved access to snowmobile “play areas.”

Visual Resources: A visual resource inventory was completed for the TRFO to provide an improved baseline for impact analysis and decision-making.

Minerals and Energy: Leasing stipulations were revised based on public comments. New stipulations were developed to mitigate potential impacts to ground water, municipal watershed, wildlife, the Old Spanish Trail, cultural viewsheds, and state wildlife areas. All stipulations were revised to state the "justification" for each stipulation and to specify the conditions under which waivers, exceptions and modifications would be considered. These stipulations are supported by the analysis in the FEIS. The LRMP includes a description of a future orderly leasing and development approach that would apply to SJNF lands Paradox Basin. Programmatic EISs for various alternative energy resources have been finalized since the Draft LRMP/EIS was published and are incorporated by reference.

Management Areas: Management area (MA) designations have been removed from BLM lands to be consistent with BLM planning guidance. While MAs no longer apply to the TRFO, the related resource-specific land allocations (i.e., lands available for grazing, available for lease, off-highway vehicle designations, etc.) are reflective of the MA preferences that were expressed by the public for each alternative. The land allocations and uses in the LRMP are consistent with the Draft and Supplement. Where On NFS lands, whereMA 5 overlapped with Colorado Roadless Areas, the MA has been changed to the adjacent MA (often MA 3). The LRMP acknowledges a more comprehensive and correct listing of past management and uses in the Pagosa District that resulted in some areas being changed from MA 3 to MA 5 and from MA 5 to MA 3. MA 8 was added to areas surrounding the Wolf Creek ski area expansion.

Lands with Wilderness Characteristics: The inventory of lands with wilderness characteristics on the TRFO was updated between the Draft LRMP/EIS and Proposed LRMP/FEIS. The results are included in the LRMP, along with guidance for managing certain TRFO lands for their wilderness characteristics under each alternative. The vast majority of these lands were identified for similar protective management in the Draft LRMP; thus, management as proposed and analyzed in this LRMP and FEIS does not differ significantly from what was disclosed in the Draft documents, and NEPA supplementation was not found to be necessary by the BLM. A detailed explanation of the wilderness characteristics inventory is included in Appendix O.

Recommended Wilderness and Wilderness Study Areas: Boundaries have been adjusted for the recommended Weminuche Adjacent and Turkey Creek areas to better follow topography and have manageable boundaries, and the Colorado Roadless Rule has been incorporated by reference. The LRMP provides direction for WSAs when they are released from WSA status by Congress.

Wild and Scenic Rivers: River corridor boundaries were revised to remove any roads within scenic and wild segments. On the SJNF, thirteen miles of the East Fork of the San Juan River were added as a suitable recommended recreation segment, and approximately six miles of the recreation segment of the West Fork of the San Juan River were removed from suitable WSR recommendation. On the TRFO Summit Canyon was removed from suitable recommendation because its one outstanding and remarkable value was shown not to exist in the canyon, and the flannelmouth sucker and Bluehead sucker were listed as outstanding and remarkable values for the Dolores River in response to comments. All of these changes are described in Appendix D.

Research Natural Areas: Some Research Natural Area boundaries were adjusted for better manageability and to address resource conflicts. Adjustments were made for the following Research Natural Areas: Martinez Creek, Porphyry Gulch, Piedra, Hidden Mesa, Grizzly Peak.

Other special areas and designations: Management direction for Chimney Rock National Monument is consistent with and references the presidential proclamation for the area. Boundaries have been adjusted for both the O'Neal Hill and Chatanooga Special Botanical Areas to remove roads, powerlines and other conflicting management. Specific management direction was added for Smoothing Iron and Boggy Draw Old Growth Recruitment Areas, and they are now within MA 3 (rather than MA 5). LRMP components were revised for Silverton based on external comments; most notably, guidance was added for improving land ownership management.

General LRMP Direction and Guidance: LRMP components have been revised to some degree within most sections of the LRMP. Revisions were based on public comments and internal review.

Administrative Corrections: Ownership layers for surface and mineral estates were corrected for both agencies, as well as updating the acres of currently leased lands. These corrections increased the total federal mineral estate acreage and changed some acreage totals throughout the documents.

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CHAPTER 1 – PURPOSE AND NEED

1.1 Introduction and Background

This Final Environmental Impact Statement (FEIS) discloses alternatives and environmental consequences for three related, but separate, decisions:

- Adopting a revised Land and Resource Management Plan (LRMP) for Bureau of Land Management (BLM) lands managed by the Tres Rios Field Office (TRFO), excluding those contained in the Canyons of the Ancients National Monument. The Responsible Official for this decision is the BLM Colorado State Director.
- Adopting a revised LRMP for the U.S. Forest Service (USFS) San Juan National Forest (SJNF). The Responsible Official for this decision is the Region 2 Regional Forester.
- Determining the SJNF lands that would be administratively available for oil and gas leasing, as well as the associated stipulations. The Responsible Official for this decision is the SJNF Forest Supervisor. (A similar decision for BLM-administered lands is made as part of the LRMP decision. The USFS considers leasing availability decisions to be separate from but closely linked to planning decisions, with both planning- and project-level components. Oil and gas leasing is analyzed together for both agencies in this FEIS.)

These decisions apply to federally administered lands only. When a proposed federal action could significantly affect the environment, the National Environmental Policy Act (NEPA) requires the preparation of an environmental impact statement (EIS). This FEIS addresses the environmental impacts of the proposed actions described in Chapter 2.

Location and Setting - The planning area, located in southwest Colorado, includes portions of the Colorado Plateau and the San Juan Mountains. This area is characterized by alpine lakes, lush meadows, craggy peaks, deep canyons, cascading waterfalls, unusual geologic formations, lower-elevation sandstone canyons and mesas, historic mines, and broad variations in elevation and climate. Located throughout this vast and richly diverse area are towns and communities that originally developed around mining and agriculture and that have transitioned in varying degrees to include recreation and tourism. The region has an abundant diversity of resources and amenities, including archeological and historical resources, geological resources (ranging from mid-Proterozoic metamorphic rock complexes to geologically recent San Juan volcanism), hydrological resources (the San Juan Mountains are the headwaters for the Rio Grande, San Juan, Dolores, and Animas Rivers), and recreational amenities (including such recreational opportunities as skiing, snowmobiling, whitewater rafting, kayaking, hiking, mountain biking, off-roading, horseback riding, fishing, hunting, motorcycle riding, photography, wildlife viewing, picnicking, scenic driving, and others).

The area also exhibits a wide diversity of ecological characteristics due to its mid-latitude location, wide range of elevations (from 4,900 to above 14,000 feet), and widely varying surficial geologic conditions (soils, slopes, rock types). The planning area includes habitats and sensitive species ranked as critically imperiled statewide and globally. The region is currently the last known location in the lower 48 states of certain arctic mosses, relics of the last ice age, and rare alpine fens. The area contains subalpine parks, grasslands and wetlands, nine stratified ecosystems (including alpine, spruce-fir, mixed conifer, ponderosa pine, oak and Douglas fir, aspen forests, parks, and meadowlands), mountain shrub communities, pinyon-juniper woodlands, and shrub-steppe communities.

The lands analyzed in this FEIS encompass approximately 1,867,800 acres of the SJNF, administered by the USFS, and approximately 504,400 surface acres and 704,300 acres of subsurface mineral estate administered by the BLM and managed by the TRFO. The Canyons of the Ancients National Monument, located within TRFO lands, is not included in this analysis because a separate management plan was prepared for that area, approved in June 2010.

The planning area is located in Archuleta, Conejos, Dolores, Hinsdale, La Plata, Mineral, Montezuma, Montrose, Rio Grande, San Juan, and San Miguel Counties (Volume III, Appendix V, Map 1). The western border of the planning area is the Utah/Colorado State line. The southern border of the planning area is the northern boundary of the Ute Mountain Ute and Southern Ute Indian Tribe reservations. The eastern border is the Continental Divide. The northern border is the administrative boundaries of the Rio Grande, Gunnison, Grand Mesa, and Uncompahgre National Forests, and the BLM Uncompahgre and Gunnison Field Offices.

1.2 Overview of the Final Environmental Impact Statement

In accordance with NEPA (42 United States Code [USC] 4321 et seq.), the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) as amended by the National Forest Management Act of 1976 (NFMA) (Section 6, 16 USC 1600), and the Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1701 et seq.), the TRFO and SJNF have prepared this FEIS to analyze the potential impacts of the TRFO Proposed LRMP, the SJNF Final LRMP, and the SJNF oil and gas leasing availability decision. In fulfillment of these and all other legal, regulatory, and policy requirements, as well as with the principles of multiple use and sustained yield, this FEIS documents the comprehensive analysis of alternatives and environmental impacts for the future management of public lands and resources administered by the BLM and USFS in southwest Colorado.

In April 2004, the USFS and BLM began this joint long-term planning effort to revise the San Juan National Forest Land and Resource Management Plan (USFS 1983) and the BLM’s San Juan/San Miguel Resource Management Plan (BLM 1985). This joint plan revision provides the opportunity for creating complimentary land management direction between the two agencies, as well as seamless public participation in the planning process.

Section 102 of FLPMA sets forth the policy for periodically projecting the present and future use of public lands, as well as their resources, using the land use planning process. Sections 201 and 202 of FLPMA establish the BLM’s land use planning requirements. The NFMA establishes the USFS’s land use planning requirements. The purpose, or goal, of the LRMP is to ensure that the SJNF and TRFO are managed in accordance with the requirements of the NFMA, FLPMA, and NEPA, as well as the principles of multiple use and sustained yield. In addition, the purpose and goal of this planning process is to provide an integrated plan that would guide future land use decisions and project-specific analyses for public lands under the management of both agencies.

The purpose of a BLM management plan is to:

- provide an overview of goals, objectives, and needs associated with public land management, and address multiple-use issues that drive the preparation of the plan; and
- guide and control future management actions and the development of subsequent, more detailed and limited scope plans for resources and uses (43 Code of Federal Regulations [CFR] 1601.0–2)

The purpose of a USFS management plan is to:

- describe the strategic guidance for forest management, including desired conditions, objectives, strategies, and guidance; and
- determine resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management (36 CFR 219.1(b) - 1982).

This FEIS has been organized consistent with applicable NEPA and Council on Environmental Quality guidelines, and is formatted to provide the reader with a clear understanding of the alternatives, the resources that may be affected, the potential environmental consequences, and the environmental review and evaluation process. This document is consistent with all applicable federal requirements guiding the preparation of a land management plan and an EIS.

Volume I (this volume) is the FEIS, which describes the BLM's Proposed Action and the USFS's Selected Alternative (Alternative B), and the other alternatives, and analyzes and discloses the environmental impacts of the Proposed Action/Selected Alternative and other alternatives. Volume I includes the following:

- **Letter to the Reader:** This letter describes how to file a protest or appeal.
- **Executive Summary:** This section provides a brief overview of discussions that are detailed in the full document. It serves as a synopsis of the planning process, as well as the purpose and need, the issues, and the alternatives resulting from the planning process.
- **Chapter 1 – Purpose and Need:** This chapter offers a brief background of the planning area. It describes the purpose and need for the action, the planning process, and related plans and relevant policy.
- **Chapter 2 – Alternatives:** This chapter describes potential management approaches or "alternatives" and discusses the process that has been used to develop alternatives. It describes four alternative land use plans, including the No Action Alternative (Alternative A) and the Proposed Action/Selected Alternative (Alternative B, also referred to as the "preferred alternative").
- **Chapter 3 – Affected Environment and Environmental Consequences:** This chapter describes the current physical, biological, human, and land use environments of the planning area (the affected environment). This description provides a baseline against which to compare the impacts of the alternatives. The baseline described in this chapter represents environmental and social conditions and trends in the planning area at the time this document was prepared. In addition, this chapter evaluates how, and to what extent, baseline conditions would be altered by the alternatives. These changes are disclosed as the environmental consequences.
- **Chapter 4 – Public Involvement and Coordination:** This chapter summarizes the public outreach and collaborative efforts that have been conducted throughout the NEPA process for this LRMP and FEIS, and the consultation processes that are required by law. This chapter also presents the names and qualifications of the people responsible for preparing the LRMP and FEIS.
- **Chapter 5 – References:** This chapter provides full citation information for all references, published and unpublished, cited in this document and used in developing the FEIS. A glossary of definitions of frequently used terms follows the references cited.

Volume II provides a more detailed description of Alternative B, the Preferred Alternative, and includes LRMP components (desired future conditions, objectives, standards, guidelines, etc.) that would apply across all alternatives with the exception of Alternative A.

Volume III provides the appendices containing additional supporting information for the LRMP and FEIS.

Proposed decisions in this document sometimes refer directly to maps and figures, and many decisions themselves are “map-based.” Therefore, the reader must rely on the text, maps, and figures, taken together as a whole, to fully understand the proposed decisions described for each alternative. All maps referenced in the FEIS may be found in Volume III, Appendix V.

1.3 The Existing Bureau of Land Management/U.S. Forest Service Land Management Plans

The SJNF and TRFO are currently managed under the following land management plans:

- The San Juan/San Miguel Resource Management Plan (BLM 1985), approved in 1985 and amended seven times.
- The San Juan National Forest Land and Resource Management Plan (USFS 1983), approved in 1983 and amended 22 times.

The existing land management plans are described in detail below.

1.3.1 The San Juan/San Miguel Resource Management Plan

The San Juan/San Miguel Resource Management Plan (BLM 1985) provides management direction for lands managed by the TRFO, with the exception of those lands within the Canyons of the Ancients National Monument, which are managed under the Canyons of the Ancients Resource Management Plan (BLM 2010a). Since being approved, the San Miguel/San Juan Resource Management Plan has been amended seven times:

- 1991 amendment related to oil and gas leasing and development;
- 1993 amendment related to the San Miguel River Area of Critical Environmental Concern (ACEC), recreation, riparian areas, and visual resources (Uncompahgre Field Office);
- 1997 amendment related to Colorado Public Land Health Standards;
- 1997 amendment related to prescribed fire direction;
- 2000 amendment related to the Grandview Ridge (urban interface) Coordinated Resource Management Plan;
- 2008 amendment related to the Geothermal Resource Leasing Programmatic Environmental Impact Statement; and
- 2012 amendment related to the Solar Energy Development Programmatic Environmental Impact Statement.

The 1991 Colorado Wilderness Study report (BLM 1991a) made wilderness recommendations for the following wilderness study areas (WSAs) in the San Juan Resource Area: Menefee, Weber, McKenna Peak, and Dolores River. In total, these WSAs consist of approximately 56,576 acres within the area

covered by this FEIS. These lands would continue to be managed under interim guidance provided by BLM Manual 6330, Management of BLM Wilderness Study Areas, until such time that Congress makes a final decision as to their wilderness status.

1.3.2 The San Juan National Forest Land and Resource Management Plan

The San Juan National Forest Land and Resource Management Plan (USFS 1983) provides management direction for the SJNF and its three Ranger Districts: Dolores, Columbine, and Pagosa. Since being approved, the 1983 San Juan National Forest Land and Resource Management Plan has been amended 22 times:

- July 30, 1986, Amendment No. 1 (added a recreation appendix);
- July 30, 1986, Amendment No. 2 (allowed minor changes to timing of projects);
- January 1, 1987, Amendment No. 3 (revised the timber sale schedule);
- August 14, 1987, Amendment No. 4 and No. 5 (changed management area [MA] prescriptions related to the East Fork ski area proposal);
- January 6, 1989, Amendment No. 6 (adjusted MA boundaries in La Plata Canyon);
- January 6, 1989, Amendment No. 7 (incorporated direction from the BLM San Juan/San Miguel Resource Management Plan into the San Juan National Forest Land and Resource Management Plan for an area of land transferred from the BLM to the USFS on October 31, 1983);
- January 6, 1989, Amendment No. 8 (amended wildlife standards and guidelines [rescinded on April 28, 1989]);
- September 7, 1990, Amendment No. 9 (adjusted MA boundaries on the Pine [now Columbine] Ranger District);
- September 7, 1990, Amendment No. 10 (adjusted MA boundaries on the Mancos [now Dolores] Ranger District);
- September 7, 1990, Amendment No. 11 (adjusted MA boundaries on the Dolores Ranger District);
- September 15, 1991, Amendment No. 12 (removed the 7-year regeneration requirement for lodgepole pine [*Pinus contorta*] from the Forest Direction);
- July 31, 1991, Amendment No. 13 (changed program budget projections);
- May 14, 1992, Amendment No. 14 (consisted of a major amendment adjusting MAs, lands suited for timber production, and allowable sale quantity (ASQ) and program harvest levels for timber; and incorporated all 13 earlier amendments);
- February 21, 1992, Amendment No. 15 (changed direction for animal damage management activities on SJNF lands);
- October 10, 1992, Amendment No. 16, (made adjustments to the budget requirement in order to incorporate changes to the timber program goals, objectives, and standards and guidelines issued through Amendment No. 14);
- December 1992, Amendment No. 17, (approved the route for the Trans-Colorado Natural Gas Transmission Line on SJNF lands);

- December 1992, Amendment No. 18 (adjusted the MA prescriptions and designation of the Falls Creek Archeological Area);
- February 24, 1994, Amendment No. 19 (established management direction for the newly acquired Piedra Valley Ranch lands);
- April 9, 1997, Amendment No. 20 (changed the prescribed fire plan);
- August 3, 1998, Amendment No. 21, (changed wilderness management direction); and
- December 3, 2012, Amendment No. 22 (changed the route density standard in one specific area within MA 3A on the Dolores District).

1.3.3 Current U.S. Forest Service Oil and Gas Leasing

SJNF lands are currently managed for leasing under the analysis and decision for the 1983 San Juan National Forest Land and Resource Management Plan. Under that plan, 1,367,769 acres were open for leasing, mostly under standard lease terms. Approximately 95,500 acres are currently leased.

Additional SJNF lands in the planning area are not currently being leased because new information and changed circumstances have made prior analyses insufficient. An up-to-date NEPA analysis is needed to identify areas available for leasing and analyze potential subsequent development in a manner compatible with other resource needs. This FEIS provides the needed analysis and leasing would continue upon finalization of the LRMP.

1.4 The Planning Process

In general, the USFS and the BLM follow the planning process outlined below. Steps 1 through 7 have been completed for the current process, and the release of this FEIS constitutes the final phase of Step 8.

- **Step 1 – Planning Issues Identified:** Issues and concerns are identified through a scoping process that solicits input from the public, special interest groups, Native American tribes, other agencies, and state and local governments.
- **Step 2 – Planning Criteria Development:** Planning criteria are created to ensure that decisions are made to address the issues pertinent to the planning effort.
- **Step 3 – Data and Information Collection:** Based on planning criteria, data and information for the resources in the planning area are collected.
- **Step 4 – Analysis of the Management Situation:** Inventory data and other information are analyzed to determine the ability of the planning area to supply goods and services and to respond to identified issues and opportunities.
- **Step 5 – Alternatives Formulation:** A range of reasonable management alternatives that address issues identified during scoping are developed.
- **Step 6 – Alternatives Assessment:** The environmental impacts of each alternative are estimated and analyzed.
- **Step 7 – Preferred Alternative Selection:** The alternative that best resolves planning issues is identified as the Preferred Alternative.
- **Step 8 – Land and Resource Management Plan Selection:** A draft LRMP and EIS are issued and made available to the public for review and comment. During the public review period, public

meetings are held to further explain the documents, address questions, and accept comments. After comments to the draft documents have been received and analyzed, the draft LRMP and EIS are revised and modified, as necessary, and a revised LRMP and FEIS are published. The portion of the LRMP addressing BLM lands is subject to a 30-day protest period, after which a Record of Decision (ROD) is issued once protests, if any, are resolved. The portion of the LRMP addressing management of National Forest Service (NFS) lands is finalized in a ROD, which is then made available for a 90-day appeal period. (The BLM's 30-day protest period occurs prior to release of the ROD, and the USFS's 90-day appeal period occurs following release of the ROD.)

- **Step 9 – Implementation:** Upon approval of the ROD, land use decisions outlined in the approved LRMP are effective immediately and would require no additional planning or NEPA analysis (except as required for individual projects).
- **Step 10 – Monitoring:** This process is intended to provide information on progress toward achieving outcomes, desired conditions and objectives, and how well management requirements such as standards and guidelines are being applied.

1.4.1 Key Decisions in the Land and Resource Management Plan

The key decisions to be made in this integrated planning process include:

- The establishment of desired outcomes, including multiple-use goals and objectives (36 CFR 219.11(b) - 1982 and 43 CFR 1601.0-5(k)(3)). These are primarily expressed as desired conditions and objectives in the LRMP.
- The establishment of management actions and requirements, including measures or criteria that would be applied in order to guide day-to-day activities (36 CFR 219.13 to 219.27 - 1982 and 43 CFR 1601.0-5(k) (2) and (4)). These are primarily expressed as standards and guidelines in the LRMP.
- The establishment of MA direction, allowable uses, allocations, restrictions, prohibitions, and availability of lands for specific uses (36 CFR 219.11(c) - 1982 and 43 CFR 1601.0-5(k)(1), (2), and (3)).
- The designation of research natural areas (RNAs), ACECs, and other special designations and areas (36 CFR 219.25 - 1982, 43 CFR 1601.0-5(k)(1) and 43 CFR 1601.7-2).
- The recommendations of NFS lands for inclusion in the National Wilderness Preservation System (36 CFR 219.17 - 1982).
- The identification of river segments that are suitable for inclusion in the National Wild and Scenic Rivers System (Public Law [PL] 90-542 and 36 CFR 219.2(a) -1982).
- The designation of suitable timber land (16 USC 1604(k) and 36 CFR 219.14 - 1982) and the establishment of ASQ (36 CFR 219.16 - 1982).
- The establishment of monitoring and evaluation requirements (36 CFR 219.11(d) - 1982, 43 CFR 1601.0-5(k)(8), and 43 CFR 1610.4-9).
- Allocation of livestock forage (animal unit months [AUMs]) and areas available for livestock grazing on BLM-administered public lands (43 CFR 4100.0-8, BLM Handbook 1601-1, Land Use Planning, Appendix C II. B).

1.4.2 Key Decisions in the U.S. Forest Service Oil and Gas Leasing Availability

A planning-related action analyzed in this FEIS is the identification of SJNF lands that would be available for oil and gas leasing, along with designation of lease stipulations to be applied to future leases (36 CFR 228.102(c) and (d)). The BLM makes decisions regarding leasing availability within its plan decisions. The oil and gas leasing availability decision consists of identifying those areas that would be:

- open to leasing, subject to the terms and conditions of the standard oil and gas lease form (including an explanation of the typical standards and objectives to be enforced under the standard lease terms);
- open to leasing, subject to lease stipulations, such as prohibiting surface use on areas larger than 40 acres, or other such standards that may be developed for stipulation use (with discussion as to why the constraints are necessary and justifiable); or
- closed to leasing, with distinction made between those areas that are closed through exercise of management direction, and those closed by law or regulation.

1.4.3 Bureau of Land Management Plan Decisions and Implementation Decisions

For the BLM, plan decisions and implementation decisions reflect two distinct steps in the planning process. Appendix C in BLM Land Use Planning Handbook H-1601-1 provides program-specific guidance to separate land use plan decisions from implementation decisions.

The LRMP analyzed in this FEIS provides broad plan decisions as described above. Implementation decisions deal with the subsequent implementation of site-specific activity plans or projects within the planning area. Implementation decisions must be consistent with the LRMP and other applicable federal statutes and regulations. In most cases, these subsequent implementation plans and decisions include additional analysis under NEPA and associated public review. Implementation decisions are also different from plan decisions in that they are not protestable under BLM regulations governing the protest process (43 CFR 1610.5-2), whereas plan decision are protestable. The only implementation decision being made in this plan is the approval of the designated route system that was proposed through the Mancos-Cortez Travel Management Plan (2009). A plan amendment for off-highway vehicle (OHV) area designations was never compelted to allow those route designations to take effect. This LRMP establishes those OHV area designations and therefore confirms the route designation implemention decisions made in that plan. Analysis of these implementation decisions occurred in the Mancos-Cortez Travel Management Plan and is not repeated in this document. There would be no other implementation decisions made as a result of this LRMP and FEIS. Therefore, implementation decisions dealing with activity- and project-level plans are not considered further in this document.

1.4.4 Multiple-level Decision-making

Land use plans are only part of a multiple-level decision-making framework for the BLM and USFS. Land use plans are designed to be consistent with national-level agency policies and regulations, as well as strategic plans that establish goals, objectives, performance measures, and strategies for each agency. They provide the broad guidance and information needed for subsequent project and activity decision-making. This LRMP would guide relevant resource management programs, practices, uses, and protection measures. Land use plans do not grant, withhold, or modify any contract, permit, or other legal instrument; subject anyone to civil or criminal liability; or create any legal rights. Land use plans also, typically, do not approve or execute projects and/or activities.

This FEIS examines potential environmental impacts that could occur as a result of land use allocations and/or the implementation of actions associated with the final planning decisions. Potential subsequent projects and/or activities are discussed in this document in order to analyze the differences between the alternatives. These projects and activities are actions that could occur, but are not necessarily authorized or approved by the LRMP, and would primarily be required to be analyzed by subsequent environmental analysis (40 CFR 1508.23). It is expected that future environmental analysis of projects and activities allowed under this LRMP would be tiered to this FEIS (40 CFR 1508.28). NEPA defines “tiering” as the coverage of general matters in broader EISs with subsequent narrower statements or environmental analyses that incorporate by reference the general discussions, allowing discussions to then concentrate solely on the issues specific to the statement subsequently prepared.

1.4.5 Consistency of Projects with the Land and Resource Management Plan

All projects and activities authorized by the BLM and USFS must be consistent with the LRMP (16 USC 1604(i) and 43 CFR 1601.5-3). A project or activity would be considered consistent with the LRMP if it is consistent with the desired conditions, objectives, standards, guidelines, allowable uses, and other management actions and decisions approved in the plan. If a project or activity as proposed would not be consistent with the LRMP, the Responsible Official has the following options: he or she must either modify the proposal so that the project or activity would be consistent, reject the proposal, or amend the plan contemporaneously with the approval of the project or activity so that the project or activity is consistent with the LRMP, as amended. The amendment may be limited to apply only to the project or activity or may apply more broadly.

1.4.6 Consistency of Projects with the Oil and Gas Leasing Availability Decision

After the oil and gas leasing availability decision is made for SJNF lands, the USFS would authorize the BLM to lease specific lands. Subsequent lease nominations submitted to the BLM by industry would be subject to verification that leasing has been adequately addressed in a NEPA document and is consistent with the LRMP, and assurance that conditions of surface occupancy identified in the leasing availability decision are properly included as stipulations in resulting leases. The BLM would also determine whether operations and development could be allowed somewhere on each proposed lease, except where stipulations prohibit all surface occupancy. Ground-disturbing activities, such as drilling exploratory wells, would require further NEPA analysis when an application for permit to drill is received. Proposals to develop a well field would also require site-specific NEPA analysis before being approved.

1.5 Purpose and Need

The Council on Environmental Quality regulations (40 CFR 1502.13) require that an EIS “briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action.” The purpose and need section of this FEIS provides a context and a framework for establishing and evaluating the reasonable range of alternatives described in Chapter 2.

1.5.1 Purpose and Need for Plan Revision

In April 2004, the BLM and USFS initiated a joint revision of the land use plans that guide management of the SJNF and TRFO. The two previous land use plans would be replaced by one coordinated plan that covers all lands administered by the two agencies, excluding the Canyons of

the Ancients National Monument. The LRMP is structured differently than a typical BLM Resource Management Plan (RMP) or a USFS Forest Plan, due to the dual-agency nature of the combined planning process. The LRMP is found in Volume II and corresponds to Alternative B, the Preferred Alternative. The ways in which other alternatives vary from the LRMP are discussed in Chapter 2 of the FEIS.

The BLM and USFS identified the need to revise the existing plans through a formal evaluation of the plans, consideration of the Analysis of the Management Situation, evaluation of monitoring findings, examination of issues identified during the public scoping process, and collaboration with local, state, and federal agencies, as well as tribes and tribal entities. Based on analysis of this information, a new plan is needed because of the social, environmental, and administrative conditions that have changed since the 1985 San Juan/San Miguel Resource Management Plan and the 1983 San Juan National Forest Land and Resource Management Plan were developed. There are higher levels of controversy around existing issues, and new, unforeseen public land issues and concerns that have arisen over the years that were not addressed in the previous plans. In addition, new resource assessments and scientific information is available to help the agencies make more informed decisions.

Management direction in the existing plans needs to be updated to:

- achieve a balance between continued traditional uses of the planning area, such as with timber harvest, grazing, and the diverse mix of recreation activities (many of which require, or are enhanced by, the maintenance of large, contiguous areas of relatively undeveloped land);
- incorporate current knowledge of the ecosystems that make up the planning area, based on new information available due to updated vegetation inventories and studies conducted since the existing plans were developed;
- reflect the increased focus that the USFS and BLM have had on ecological restoration since the existing plans were developed;
- incorporate current knowledge about the role of natural fire, insects, disease, and other disturbance processes in the ecosystems that make up the planning area;
- reflect changes in the wood products industry that have occurred since the 1992 significant amendment to the San Juan National Forest Land and Resource Management Plan;
- represent the increased focus on working with communities in order to reduce the risk of wildfire in the wildland-urban interface (WUI) in residential areas;
- achieve a balance between energy production needs and the protection of other resources;
- acknowledge the population growth in local communities and the increased emphasis on public lands amenities used by people living near the planning area;
- incorporate the increased knowledge of the types of benefits, settings, and opportunities people are seeking when they recreate in the planning area;
- help resolve travel management conflicts and provide a better basis for subsequent site-specific decisions on designating routes for motorized travel;
- update land allocations related to potential and existing downhill ski areas (East Fork, Wolf Creek Valley, and Wolf Creek) in order to reflect changed conditions;
- encourage working collaboratively with stakeholders in order to balance water development opportunities and protect other resources;

- reflect the emphasis on key areas of the planning area that have unique and outstanding features and legal definition; and
- incorporate an updated inventory of river segments that meet the eligibility requirements of the Wild and Scenic Rivers Act (WSRA) and determine the best mechanisms to protect their outstandingly remarkable values while, at the same time, balancing competing opportunities for water development and other uses.

Existing decisions were reviewed for their relevance, as well as for their potential effectiveness, in the continued management of resources. Relevant decisions from the existing agency land use plans and any activity plans would be carried forward. Examples include decisions from the Wild Horse Appropriate Management Level in the Spring Creek Basin HMA (EA #CO-800-2005-027) (BLM 2005a), the San Juan-Rio Grande National Forests Wilderness Management Direction (USFS 1998), and the Colorado Wilderness Study Report (BLM 1991a).

1.5.2 Purpose and Need for the U.S. Forest Service Oil and Gas Leasing Availability Decision

In order to respond to formal requests for oil and gas leases, the USFS needs to identify SJNF lands that would be available for oil and gas leasing. The need for identifying lands available for leasing arises from the public's demand for energy, specifically oil and natural gas, and the federal government's policy to "foster and encourage private enterprise in… the orderly and economic development of domestic mineral resources" (Mining and Minerals Policy Act of 1970).

The purpose of making NFS lands available for oil and gas leasing is to facilitate the production of energy resources in support of local and regional economies and a secure and stable domestic energy supply. Making lands on the SJNF available for oil and gas leasing would contribute to meeting the need for energy resources developed and produced in an environmentally sound manner.

Oil and gas leasing on the SJNF would be consistent with the revised LRMP, comply with the requirements for leasing analysis and decisions at 36 CFR 228.102, allow processing of pending lease nominations (approximately 360,000 acres, mostly on the western portion of the SJNF) and future nominations, and be consistent with the Colorado Roadless Rule.

1.6 Planning Issues

NEPA requires that federal agencies hold an open and early process for determining the scope of issues that could be associated with the Proposed Action. The term "scope" is defined as the range of actions, alternatives, and impacts to be considered during NEPA analysis. The objectives of the scoping process for this planning effort were to identify potentially interested parties, identify public and agency concerns, define the range of issues to be addressed in the LRMP, ensure that relevant issues were identified early and guided the process, and establish a public record. To achieve these objectives, the SJNF and TRFO conducted a broad community-based scoping process described in Chapter 4.

Planning issues identify demands, concerns, and/or conflicts regarding the use and management of public lands and typically express potential impacts on land and resource values. The main topic areas addressed in the LRMP and FEIS were identified based on input from interagency consultation, other federal agencies, state and local governments, cooperating agencies, the public, industry representatives, and special interest groups. The issues represent the challenges that exist with

current management. The SJNF and TRFO documented each of the issues in a scoping report and placed each in one of three categories:

1. Issues to be resolved in the LRMP, oil and gas leasing availability decision, and EIS;
2. Issues to be resolved through policy or administrative action; and
3. Issues beyond the scope of the LRMP, oil and gas leasing availability decision, and EIS.

The scoping report provided rationale for each issue placed in category 2 or 3. The identified issues in category 1 are addressed in Alternative B, the Preferred Alternative. The other alternatives vary in terms of program emphasis, land allocations, and suitable uses. Not all aspects of the existing land management plans need to be changed; consequently, some things are held constant between alternatives.

Four main issues were derived from the scoping process and guided the development of alternatives in this FEIS. The alternatives reflect where people had notably different ideas about how to manage or use different areas administered by the SJNF and TRFO. These different ideas came from the community study groups, scoping meetings, written comments, and other scoping activities. These issues are described below.

Issue 1: Balancing Management between the Ideas of Maintaining “Working Forest and Rangelands” and Retaining “Core Undeveloped Areas”

Two key features of the planning area include its large expanses of relatively pristine lands and the broad mix of traditional uses and activities that still occur throughout much of the area. Much of the discussion in community meetings focused on how much people value these features and how to best maintain a good balance between them.

When people discussed maintaining a “working forest,” the emphasis included respecting valid and existing rights to resources, retaining access and commodity production activities that are important to the economy of local communities, and continuing historical uses in areas where access and infrastructure investments have already been made.

The desires expressed by the people who discussed retaining “core undeveloped areas” included retaining areas that have not been developed in order to provide high-quality wildlife habitat and corridors, minimize ecosystem fragmentation, and support natural ecosystem functions. Maintaining the roadless character of much of the planning area was identified as important by wildlife managers, sportsmen, recreationists, and many interested citizens.

Issue 2: Providing Recreation and Travel Management within a Sustainable Ecological Framework

The lands administered by the SJNF and TRFO are becoming increasingly important as a scenic backdrop, as well as a place to recreate, to residents of nearby communities and people visiting the area. Discussions at community meetings often included the need to find a balance between the way long-time residents, new arrivals, and visitors use the public lands. There was also much discussion on achieving a balance between areas where motorized recreation would be allowed and where non-motorized forms of travel and recreation would dominate. Opinions were divided on the appropriate mix of different types of recreation settings and opportunities that should be provided on public lands. Opinions also differed on where to emphasize motorized travel versus non-motorized travel.

Issue 3: Management of Special Area Designations and Unique Landscapes

A number of unique and special areas were identified during the scoping process as meriting special attention. The importance of maintaining scenic views and recreation opportunities along important travel routes, such as along the San Juan Skyway, the Alpine Loop Backcountry Byway, the Continental Divide National Scenic Trail (CDNST), and the Colorado Trail, were common to all interests and areas represented across the alternatives. Some established designations, such as the Spring Creek Wild Horse Herd Management Area (HMA), were also carried forward in all alternatives. Suitability of roadless areas of the SJNF for inclusion in the National Wilderness Preservation System and the suitability of rivers and streams on both SJNF and TRFO lands for inclusion in the National Wild and Scenic Rivers System are examined and analyzed in alternatives. Alternative ways of managing some unique landscapes, including the Dolores River Canyon, Silverton, Rico, and the HD Mountains, are also examined.

Issue 4: Management of Oil and Gas Leasing and Development

The lands administered by the SJNF and TRFO contain several areas with moderate to high potential for oil and gas resources. A key challenge for the future is providing for potential energy development while, at the same time, protecting other resource values. People expressed concerns regarding both where and how development might occur.

Community participants noted that plan decisions and oil and gas leasing availability decisions need to be coordinated so that the infrastructure needs (roads, well pads, and pipelines) for oil and gas development are compatible with desired conditions for specific areas of land. Comments mostly related to whether new road construction should occur in areas that are currently undeveloped. Areas available for leasing vary by alternative in order to reflect the different land allocations and management emphases in the alternatives.

Lease stipulations provide protection for other resource values and land uses, such as unique soil conditions, steep slopes, ecological integrity, wildlife habitat, cultural resources, high-use recreation areas, and scenic quality. Stipulations would be applied to new leases in order to respond to issues of how development might occur.

1.7 Applicable Laws

A broad range of federal policies, decisions, and laws guide development of the LRMP, EIS, and the oil and gas leasing availability analysis. Key laws with bearing on the decisions are discussed below. Additional planning guidance for both agencies is included in several executive orders (EOs), agency manuals and handbooks, policy memorandums, and regulations and laws where applicable.

Most aspects of the BLM and USFS planning processes have been combined. Where laws, regulations, and/or policies that govern planning for each agency differ, the planning process and associated documents remain separated and are clearly identified as applying to only one agency.

Federal Land Policy Management Act of 1976

FLPMA establishes the land management authority of the BLM and provides guidance for how public lands are to be managed by the BLM. The BLM manages public lands on the basis of multiple use and sustained yield. It requires that the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values be protected. Sections 201 and 202 of FLPMA establish the BLM’s land use planning requirements.

National Forest Management Act of 1976

The NFMA amended the Forest and Rangeland Renewable Resources Planning Act of 1974 to require preparation of land management plans for national forests and national grasslands. Land management plans provide guidance and direction to the agency for all resource management activities on the unit. Under the NFMA, the USFS must prepare land management plans using an interdisciplinary team and public participation. In addition, the USFS must comply with NEPA in the development, review, and revision of land management plans. Permits, contracts, plans, and other instruments used in managing NFS lands—such as timber sale contracts, grazing permits, and mine reclamation plans—must be consistent with the land management plan.

National Environmental Policy Act of 1969

NEPA established a national policy to maintain conditions under which people and nature can exist in productive harmony while, at the same time, fulfilling the social, economic, and other requirements of present and future generations of Americans. It established the Council on Environmental Quality in order to coordinate environmental matters at the federal level and advise the President on such matters. Under the law, all federal actions that could result in a significant impact on the environment are subject to review by federal, state, local, and tribal authorities, as well as by affected parties and interested citizens.

Clean Air Act of 1963

Congress passed the Clean Air Act in 1963, the Air Quality Act in 1967, the Clean Air Act Extension of 1970, and Clean Air Act Amendments in 1977 and 1990. The 1963 Clean Air Act relied on states to issue and enforce regulations regarding air pollution. Congress amended the Clean Air Act in 1970 and established the U.S. Environmental Protection Agency (EPA) to set and enforce national standards for air pollution. In 1990, the EPA was authorized to set National Ambient Air Quality Standards (NAAQS), which establish acceptable concentrations of six criteria pollutants: ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb), nitrogen dioxide (NO_2), and particulate matter less than 2.5 microns in size ($PM_{2.5}$).

Clean Water Act of 1972

The Clean Water Act, or the Federal Water Pollution Control Act, is the principal law governing pollution of the nation's surface waters (33 USC 1251). Originally enacted in 1948, it was revised, by subsequent amendments, to spell out programs for water quality improvements; programs that are still being implemented by industries and municipalities. The Clean Water Act consists of two major parts. The first provision authorized federal financial assistance for municipal sewage treatment plant construction. The second provision, which is regulatory, established a national policy to maintain conditions under which people and nature can exist in productive harmony while, at the same time, fulfilling social, economic, and other requirements.

Endangered Species Act of 1973

Management activities on private and public lands are subject to the Endangered Species Act (ESA), as amended. It directs project proponents or government agencies, as appropriate, to consult with the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration Fisheries Service in order to address the impacts of management activities on threatened and endangered species and designated critical habitat. This consultation leads to the issuance of a Biological Opinion (BO) and may result in the issuance of a Section 10(a) (for non-federal actions) or Section 7 permit (for federal actions) by the USFWS and/or the National Oceanic and Atmospheric Administration Fisheries Service. The SJNF and TRFO are consulting with the USFWS regarding any

actions under the LRMP that may affect ESA listed species. To this end, a biological assessment (BA) has been prepared for the actions proposed through the LRMP.

The National Historic Preservation Act

The National Historic Preservation Act (NHPA) is the primary federal law providing for the protection and preservation of cultural resources. The NHPA established the National Register of Historic Places (NRHP), the Advisory Council on Historic Preservation, and the State Offices of Historic Preservation.

The Migratory Bird Treaty Act of 1966

The Migratory Bird Treaty Act (MBTA) is the domestic law that implements the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. Under this law, all migratory birds and their parts (including eggs, nests, and feathers) are fully protected. Each of the conventions protects select species of birds that are common to multiple countries (i.e., they occur in more than one country at some point during their annual life cycle). The law is implemented by the USFWS. The SJNF and TRFO would be required to manage the bird populations on the lands they administer consistent with the requirements of the MBTA.

Multiple-Use and Sustained-Yield Act of 1960

The Multiple-Use and Sustained-Yield Act of 1960 (MUSY) states, "National Forests are established and administered for outdoor recreation, range, timber, watershed, and fish and wildlife purposes" (16 USC 528). Through the MUSY, the Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained therein. In the administration of the national forests, due consideration shall be given to the relative values of the various resources in particular cases. The Secretary of Agriculture is also authorized to cooperate with state and local governmental agencies in management of national forests (16 USC 529).

Mineral Leasing Act of 1920, as amended

The Mineral Leasing Act provides for the leasing of deposits of coal, phosphate, sodium, potassium, oil, oil shale, native asphalt, solid and semi-solid bitumen, and bituminous rock or gas, and lands containing such deposits owned by the United States, including those in national forest, but excluding those acquired under other acts subsequent to February 25, 1920.

Federal Onshore Oil and Gas Leasing Reform Act of 1987

The Federal Onshore Oil and Gas Leasing Reform Act amended the Mineral Leasing Act of 1920 by establishing a new oil and gas leasing system, and changing certain operational procedures for onshore federal lands. The Federal Onshore Oil and Gas Leasing Reform Act states that the BLM cannot lease over the objection of the USFS and authorizes the USFS to regulate all surface-disturbing activities conducted pursuant to a lease on NFS lands. The act requires the USFS to evaluate lands within national forests for potential oil and gas leasing. The USFS decides whether lands would be available for leasing and decides under what conditions (stipulations) the leases would be issued.

Mining and Minerals Policy Act of 1970

The Mining and Minerals Policy Act declares that it is the continuing policy of the federal government in the national interest to foster and encourage the orderly and economic development of domestic

mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs.

Energy Policy Act of 2005

The Energy Policy Act provides for the Secretaries of the Interior and Agriculture to designate, under their respective authorities, corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on federal land in the 11 contiguous western states (as defined in Section 103(o) of FLPMA (43 USC 1702(o)). Designated corridors are to be incorporated into USFS and BLM land use plans.

Energy Security Act of 1970

The Energy Security Act established the intent of Congress that the Secretary of Agriculture shall process applications for leases of NFS lands and for permits to explore, drill, and develop resources on land leased from the USFS, notwithstanding the current status of land management plans.

The Brunot Agreement

The Brunot Agreement, ratified by Congress in 1874, withdrew over 5,000 square miles in the mountains of southwest Colorado from the 1868 Ute Reservation. The agreement, entered into between the United States (as represented by Felix Brunot) and the Ute Indians in Colorado, was passed into law (18 Stat., 36) by the House of Representatives and the Senate of the U.S. Congress on April 29, 1974. Under the “reserved rights doctrine,” hunting rights on reservation lands relinquished by the Utes were retained; that is, the tribes retained such rights as part of their status as prior and continuing sovereigns. Article II of the Bruno Agreement specified “the United States shall permit the Ute Indians to hunt upon said lands so long as the game lasts and the Indians are at peace with the white people.” The Ute Mountain Ute Tribe’s hunting rights were acknowledged when the tribe sued the State of Colorado for their historical hunting rights in 1978. The rights were granted to the tribe under a consent decree that gave enrolled members of the Ute Mountain Ute Tribe the right to hunt deer and elk in the Brunot area for subsistence, religious, or ceremonial purposes. The consent decree specified that tribal members may hunt deer and elk without a state license year-round, providing that they obtain a tribal hunting permit. In 2013, the Ute Mountain Ute Tribe re-negotiated this agreement with the State of Colorado to include the Tribe’s fishing rights and the right to hunt a certain number of black bears, moose, mountain goats, big horn sheep and mountain lions, in addition to the existing take of elk and mule deer within the Brunot area. Other game animals may be hunted without a license and without bag limits, but only during hunting seasons established by Colorado Parks and Wildlife (CPW). In 2008, the Southern Ute Indian Tribe signed an agreement with the State of Colorado which reinstated their hunting and fishing rights within the Brunot area. The SJNF and TRFO will continue to ensure that the hunting and fishing rights of the 1873 Brunot Agreement are upheld on public lands under their management jurisdictions. In exercising their Brunot hunting rights, the Ute Mountain Ute and Southern Ute tribal members are required to adhere to federal policy and regulations designed to protect natural and cultural resources.

CHAPTER 2 – ALTERNATIVES

This chapter presents four LRMP alternatives that represent different approaches to the management of the public lands and resources administered by the USFS and BLM. The alternatives discussed in this chapter include the No Action Alternative (labeled Alternative A) and three other alternatives (labeled Alternative B, Alternative C, and Alternative D). A No Leasing Alternative for oil and gas is also analyzed as part of the oil and gas leasing availability decision.

Chapter 2 includes the following discussions:

- **2.1 Development of Alternatives:** This section describes how the alternatives were developed during the agency and public scoping process, as well as how each alternative emphasizes or reflects different aspects for managing the SJNF and TRFO.
- **2.2 Important Points Common to All Alternatives:** This section describes how the alternatives represent, to varying degrees, the principles of multiple use and sustained yield of USFS- and BLM-administered lands in the planning area, as directed by all applicable laws, rules, regulations, standards, policies, and guidelines.
- **2.3 Alternatives Considered but Eliminated from Further Analysis:** This section describes several issues that were raised during the scoping process that were considered, but not carried forward, for further analysis as alternatives.
- **2.4 Comparison of Alternatives:** This section explains the differences among the alternatives related to the primary revision issues and related LRMP decisions.
- **2.5 Summary and Comparison of Environmental Consequences:** This section provides a comparative summary of the effects of the alternatives on each resource.

2.1 Development of Alternatives

Land use planning regulations and NEPA require the USFS and BLM to develop a range of reasonable alternatives during the planning process. The basic goal of developing alternatives is to prepare different combinations of management scenarios in order to address all identified issues and resolve conflicts among uses. Alternatives must meet the purpose and need; must be reasonable; must provide a mix of resource protection, use, and development; must be responsive to the issues; and must meet the established planning criteria. Under all of the alternatives, the SJNF and TRFO would manage the public lands in accordance with all applicable laws, regulations, policies, standards, and guidelines.

The development of alternatives for this LRMP/FEIS was guided by applicable provisions of the NFMA and FLPMA, applicable LRMPs, and implementation of NEPA. Management actions (alternatives), including the No Action Alternative, were developed in order to address planning issues, concerns, and requirements, and to provide direction for resource programs influencing land management and resource use in the planning area. The alternatives were developed using an iterative process that focused on improving current management. Each management alternative would represent a different combination of resource uses, management allocations, and environmental consequences (see Chapter 3).

The development of the alternatives analyzed in this LRMP/FEIS included a public scoping process that allowed interested members of the public, Native American tribal governments and entities, special interest groups, and federal, state, and local government agencies to comment on and

contribute input with regard to the planning process. On September 23, 1999, a Notice of Intent (NOI) to revise the USFS San Juan National Forest Land and Resource Management Plan was published in the *Federal Register*. On December 14, 2004, a second NOI was published, updating timelines and informing all interested parties that the BLM San Juan/San Miguel Resource Management Plan would be revised concurrently.

Detailed analyses of conditions and trends for social, economic, and ecological elements related to the planning area were developed early in the process. These analyses included consideration of relevant new information, as well as legal, regulatory, and policy changes that have occurred since the last planning period. Results from the analyses were used in the public scoping process in order to inform stakeholders, focus the issues, and enhance overall communication.

The public scoping process began in January 2005. Alternatives were developed using a community participation process that centered on a series of meetings held in local communities. Web-based mechanisms were also offered so that all interested parties could interact using the Internet. People were encouraged to participate in the entire series of community study group meetings in order to build upon knowledge gained during earlier meetings and to stay informed as alternative development progressed. It was a mutual learning experience for both community members and agency personnel.

During the scoping process, public lands in the planning area were divided into 33 smaller landscapes. This was done so that people could discuss conditions, concerns, and solutions for issues in the context of specific places, rather than at an abstract level. Scoping participants identified outstanding features, primary uses, concerns with current management, and opportunities for improvement for each landscape. Alternative development was also influenced by consultation and discussions with other federal agencies, state and local governments, cooperating agencies, Native American tribal agencies, CPW, Colorado’s Roadless Areas Review Task Force, the Governmental Water Roundtable (a group convened to give water input specific to the LRMP), and local recreation organizations, as well as written comments from all interested parties.

During the community study group meetings, management direction for areas was depicted primarily in terms of MAs that varied in levels of development and suitability for different uses and/or activities. The interdisciplinary team and staff created a preliminary draft of MA allocations by translating the BLM Emphasis Areas and SJNF management prescriptions found in the two existing land management plans into MAs. These preliminary land allocations were used as a starting point for community study group discussions about their preference for how areas should be managed. Using a spectrum of MAs ranging from MA 1 (Natural Processes Dominate, i.e., very little if any management or uses allowed) to MA 5 (Working Forest and Rangelands, i.e., areas where management and uses are likely, evident, and encouraged) to MA 8 (Permanently Developed Lands, i.e., applied to areas with dams or downhill ski areas), the public expressed their preference for how areas should be managed. A description of the MAs used in the community study groups is provided in Chapter 3 of the LRMP.

For many areas within each landscape, participants agreed with the proposed land allocations; for other areas, people suggested changes and described their rationale for the changes. Areas with varying preferences for management and allowable uses were used to develop the alternatives analyzed in this FEIS.

2.1.1 Application of Management Areas

As described above, the composition of MAs were used in the public scoping meetings as a starting point for developing alternatives with the public. For the FEIS, resource suitability and allowable

resource use decisions have been used in addition to MAs for analyzing impacts and describing how each alternative responds to the four issues and related LRMP decisions. Resource-specific allocations compliment the MA preferences identified during public scoping, including but not limited to lands suitable for timber production, lands suitable and capable for livestock grazing, and lands available for lease, areas open, closed, or limited to motorized use. These resource decisions and related MA allocations on SJNF lands are further described in Section 2.4.1 below.

MA allocations have been removed from BLM lands in the LRMP to be consistent with BLM planning guidance (USFS planning regulations require designation of MAs, while BLM planning regualtions contain so such requirement). While MAs are no longer proposed to apply to BLM lands on the TRFO, the related resource-specific land allocations are reflective of the MA preferences that were expressed by the public for each alternative, and these allocations are consistent with BLM's planning direction.

2.1.2 Supplement to the Draft Environmental Impact Statement

During the 120-day public comment period for the Draft LRMP/EIS, we received comments suggesting that the Reasonable Foreseeable Development (RFD) scenario for oil and gas development projections in the Paradox Basin were low because the draft did not consider the development potential of Gothic Shale gas, a potential new shale gas development play underlying portions of Montezuma, Dolores, and San Miguel Counties. These comments and supporting documentation indicated that the following conditions used in the USFS's and BLM's oil and gas leasing and development analysis had changed:

- geologic source potential: the emergence of a Gothic Shale Gas Play (GSGP) area in southwest Colorado identified as having high resource potential;
- development technology: the advancement of horizontal drilling and hydraulic fracturing, which makes extraction of gas from shale formations possible and more economical; and
- demand and activity: there has been significant leasing interest from industry on federal mineral estate within the GSGP area since the release of the Draft EIS and increased permitting activity on non-federal mineral estate lands within the GSGP area.

The USFS and BLM also received comments on the Draft LRMP/EIS suggesting that the type of air quality model used was inappropriate for the scale of the plan and that capabilities of the model as used in the Draft EIS had been exceeded. The USFS and BLM considered all of this information and, through further technical evaluation, determined that 1) the GSGP was a high potential play that should be evaluated and 2) a more detailed air quality model and analysis was needed to adequately represent potential air quality impacts in the planning area and disclose results specific to the new development projections for the GSGP area. Hence, it was determined that a Supplement to the Draft EIS was needed in order to incorporate this new information and analysis into the Draft LRMP/EIS.

A Supplement to the Draft EIS was released on August 26, 2011, for a 90-day public review and comment. Comments received on both the Draft LRMP/EIS and the Supplement to the Draft EIS were used in developing the final set of alternatives analyzed in this Final EIS.

2.2 Important Points Common to All Alternatives

Each of the LRMP alternatives would:

- protect basic soil, air, water, and land resources in order to encourage long-term, healthy, and sustainable ecosystems;
- meet the BLM Colorado Public Land Health Standards;
- provide for diverse ecosystems;
- emphasize the important role that federal lands play in providing for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives. Fish and wildlife habitat is managed to maintain viable populations of existing native and desired non-native vertebrate species on SJNF lands.
- provide recreation settings and maintain scenic quality in response to the needs of USFS and BLM public land users and local communities;
- protect heritage resources, in accordance with applicable laws and regulations, while, also providing educational opportunities at appropriate sites;
- sustain multiple uses, products, and services (including timber harvesting, livestock grazing, locatable and leasable minerals development, and recreational uses);
- emphasize improved landownership and access patterns that would benefit both private landowners and the public;
- emphasize cooperation with individuals, organizations, Native American tribes, and other agencies in order to better coordinate the planning and implementation of projects;
- implement the revised standards, guidelines, and other referenced guidance found in the LRMP;
- promote rural development opportunities in order to enrich cultural life, enhance the environment, provide employment, and improve living conditions;
- promote actions that would continue to encourage active public participation in the planning and management processes; and
- manage the roadless areas in compliance with the Colorado Roadless Rule. (On the SJNF, 566,100 acres are inventoried as Colorado Roadless Areas [CRAs].)

A number of designations and activities would not change under the alternatives, including:

- existing ski-based resorts (although boundaries may vary by alternative);
- existing components of the National Wilderness Preservation System;
- existing developed recreation sites, utility corridors, and electronic sites;
- currently designated national scenic and recreation trails;
- currently designated scenic byways;
- currently designated NRHP and archeological districts;
- currently designated BLM wilderness study areas (WSAs);
- currently designated BLM Wild Horse HMAs;
- the development of coalbed methane (CBM) gas in the HD Mountains (as described in the ROD for the Northern San Juan Basin EIS [USFS and BLM 2007]), although availability of that area for new leases may vary by alternative;

- existing current, valid mineral lease rights (lands leased prior to the date of this plan decision would be subject to valid existing rights under lease terms and may be conditioned to be in compliance with the LRMP); and
- currently withdrawn areas from oil and gas leasing within SJNF lands, including designated wilderness areas—Lizard Head, Weminuche, and South San Juan—and the Piedra area.

2.3 Alternatives Considered but Eliminated From Further Analysis

Several alternatives were considered during the planning process, but were eliminated from further detailed analysis. The planning team used input, past management experience, and laws and regulations in designing the alternatives that were analyzed in detail during the planning process. Many of the suggestions proposed by interested parties and the public were used to develop and shape the analyzed alternatives even if they were presented in an alternative that was not carried forward in its entirety. The following are alternatives not considered in detail, including the reasons why they were eliminated:

2.3.1 Exclusive Use or Elimination of Traditional Uses Alternatives

Alternatives proposing exclusive use, or protection of one resource at the expense of other resources, were not considered. Several laws mandate that the BLM and USFS manage public lands for multiple uses and sustained yield. This legal and regulatory requirement eliminates exclusive-use alternatives, such as alternatives that would close all public lands to livestock grazing or those that would manage for wildlife values only at the expense of other resource considerations. Several proposed alternatives for exclusive use or elimination of traditional uses are detailed below.

No Livestock Grazing Alternative: This alternative would close the entire planning area to livestock grazing. This alternative was eliminated from detailed analysis for several reasons. NEPA requires that agencies study, develop, and describe appropriate alternatives in order to recommend courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources. No issues or conflicts have been identified during this land use planning process that would require the complete elimination of livestock grazing within the planning area as a resolution. No comments were received during the scoping process that suggested a no livestock grazing alternative should be considered, and the agencies received feedback from the public during LRMP study group meetings that a no livestock grazing alternative would not contribute to addressing the issues that the plan should focus on. Concerns over livestock grazing in some localized areas were brought to the managing agencies. Closures and adjustments to livestock use have been incorporated in the alternatives, as appropriate, on an area basis in order to address these issues. The USFS and BLM have considerable discretion through their livestock grazing regulations to determine and adjust stocking levels, seasons-of-use, and livestock grazing management activities, as well as to allocate forage. For these reasons, an alternative proposing no livestock grazing for the entire planning area is not needed and has been dismissed from further consideration in this analysis.

No Coalbed Methane Gas Development in the HD Mountains Alternative: This alternative would prohibit further development of existing oil and gas leases in the HD Mountains. However, this alternative would not be practical, due to valid existing rights. A number of persons also asked that the HD Mountains be recommended for inclusion in the National Wilderness Preservation System and/or be managed as an MA 1, where natural processes dominate. The HD Mountains Roadless

Area was analyzed but was found to not be available for wilderness, due to its high mineral potential, approved plans, and current development of existing oil and gas leases within the area.

The ROD for the Northern San Juan Basin Coalbed Methane (NSJB-CBM) Development EIS (USFS and BLM 1982) describes how development of current leases would proceed in the HD Mountains. This land management plan EIS addresses future management of the HD Mountains, including whether the area should be available for leasing after the current leases expire.

Maximum Timber Yield Alternative: This alternative would maximize timber production. This alternative was considered, but eliminated, because it was not considered reasonable given the required consideration of other resource desired conditions and objectives, likely budget levels, local mill capacities, and expected demand for timber products.

Citizens for the Wild San Juan's Alternative: As presented to the SJNF and TRFO, this alternative's goal would be to expand large, wild core habitats; return native fish and wildlife species; secure critical landscape connections; and promote living, working, and playing in harmony with native species and wild habitats in the planning area. In its entirety, this alternative would not meet the purpose and need for the new land management plan. The San Juan Citizens Alliance presented the alternative to the SJNF and TRFO, with endorsements from the Southern Rockies Ecosystem Project, the Wilderness Society, the Sierra Club – Rocky Mountain Chapter, the Rocky Mountain Recreation Initiative, the Center for Native Ecosystems, the Sinapu, the Biodiversity Conservation Alliance, the Colorado Environmental Coalition, the Colorado Wild, the Western Resource Advocates, and the Upper Arkansas South Platte Project.

This alternative, along with similar comments and suggestions from participants in the community study group process, was the primary basis for Alternative C. Many ideas from this alternative would be represented under Alternative B, and, to a lesser extent, Alternative D. The exact alternative was not analyzed in detail because it included wilderness recommendations for some lands that were found not to be capable or available for wilderness and Wild and Scenic River (WSR) recommendations for some stream segments that were found not to be eligible for WSR status.

The Citizens Wilderness Proposal Alternative: This alternative advocates citizens proposed wilderness areas for the SJNF and TRFO. In its entirety, this alternative would not meet the purpose and need for the new land management plan. This alternative was presented to the SJNF and TRFO by the San Juan Citizens Alliance, the Colorado Environmental Coalition, the Wilderness Society, the Southern Rockies Ecosystem Project, the Rocky Mountain Recreation Initiative, the Colorado Wild, the Sinapu, the Central Colorado Wilderness Coalition, the Sierra Club – Rocky Mountain Chapter, the Western Resource Advocates, the Upper Arkansas South Platte Project, the Colorado Mountain Club, the Center for Native Ecosystems, and the San Luis Valley Ecosystem Council.

Most of the proposal's wilderness recommendations are represented by Alternative C. The exact citizens' alternative was not analyzed in detail because it included wilderness recommendations for some lands that were found to not be capable or available for wilderness, or it contained areas on BLM lands, and BLM does not have the authority to recommend new wilderness areas or create new WSAs. Although the addition of new WSAs, or boundary changes to existing WSAs, was not considered in detail, several of the areas identified in the citizen's wilderness proposal on BLM lands are addressed through the TRFO's inventory of lands with wilderness characteristics, which is discussed in Volume III, Appendix O.

2.4 Comparison of the Alternatives

The 2007 Draft LRMP/EIS described and analyzed four alternatives, including Alternative A (the No Action Alternative), Alternative B (the Preferred Alternative), and Alternatives C and D, each of which represents different ways to achieve the stated goals and objectives. These four alternatives are carried into the FEIS for analysis and consideration. Each alternative was developed based on response to the following factors:

- balance of use and protection of resources as described by the four planning issues;
- extent of the environmental impacts; and
- public comments on the Draft LRMP/EIS and Supplement to the Draft EIS.

Alternative A represents the continuation of current management direction under the existing BLM and USFS land management plans: the BLM's San Juan/San Miguel Resource Management Plan (1985) and the San Juan National Forest Land and Resource Management Plan (1983), both as amended. Alternative A meets the NEPA requirements that a No Action Alternative be considered (40 CFR 1502.14). "No Action" means that the alternative reflects the implementation of existing management goals, objectives, and management practices based on the existing land use plans. Alternative A also serves as the baseline for comparing and contrasting the impacts of the other alternatives. Alternative A is based on reasonably foreseeable actions, existing planning decisions and policies, and existing land use allocations and programs.

Alternative B, the Preferred Alternative, focuses on balancing the goals of maintaining working forest and rangelands and retaining core, undeveloped lands and providing and maintaining the full diversity of uses and active recreation opportunities. Uses and activities that require roads, such as timber harvesting and oil and gas development, would be mostly focused in areas that already have roads, while the relatively undeveloped areas and areas that currently do not have roads would, for the most part, remain that way. Alternative B was chosen because it responds best to the major issues while providing for common ground among conflicting opinions and multiple uses of public lands in a sustainable fashion. Alternative B also incorporates the goals of the USFS's Strategic Plan (36 CFR 219.12(f)(6)) and the U.S. Department of the Interior's (USDI's) Strategic Plan. The Responsible Officials, the Regional Forester for NFS lands and the State Director for BLM-administered lands, have identified Alternative B as the Preferred Alternative in this FEIS.

Alternative C provides for a mix of multiple-use activities with a primary emphasis on maintaining the undeveloped character of the planning area. Production of goods from vegetation management would continue, but might be secondary to other non-commodity objectives. Under Alternative C, production of goods and services would be more constrained than that proposed under Alternatives A, B, and D. Alternative C identifies more resources and areas for special designation than the other alternatives and overall emphasizes the undeveloped areas and non-motorized recreational activities to a greater degree than any of the other alternatives.

Alternative D provides for a mix of multiple-use activities, with a primary emphasis on working forest and rangelands in order to produce a higher level of commodity goods and services when compared to the other alternatives. Alternative D allocates the least amount of land for special designation. Under Alternative D production of goods and services would be greater than that proposed under Alternatives B and C.

2.4.1 Management Areas

MAs apply to all SJNF lands within the planning area. MAs describe the intensity of management that can be expected within each MA, ranging from areas where natural processes dominate and shape the landscape to areas that are intensely managed. MAs also provide a general sense of how the landscape would appear and identify uses and activities that are allowed for programs such as grazing, timber, motorized recreation, etc. A full description of each MA is provided in Chapter 3 of the LRMP. The description of how MAs vary by alternative is included now for context, since MAs are referred to in the comparisons of issues and LRMP decisions that follow (acreages are provided in Table 2.4.1). See Volume III, Appendix V, Maps 2 through 5 for a display of MAs by alternative.

Table 2.4.1: Management Area Allocations on San Juan National Forest Lands

Management Area Allocations	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
MA 1 - Natural Processes Dominate	483,869	598,517	1,016,281	497,856
MA 2 - Special Areas and Unique Landscape Areas	8,949	91,985	86,295	59,602
MA 3 - Natural Landscape, with Limited Management	755,418	596,119	245,753	710,990
MA 4 - High-Use Recreation Emphasis	148,022	69,864	46,502	79,854
MA 5 - Active Management	454,035	451,730	426,507	454,137
MA 7 - Public and Private Lands Intermix	0	49,560	40,679	49,547
MA 8 - Highly Developed Areas	14,538	7,056	2,814	12,845
Total Acres	**1,864,831**	**1,864,831**	**1,864,831**	**1,864,831**

Alternative A was developed by translating the San Juan National Forest Land and Resource Management Plan (1983) management prescriptions to MAs. MA 1 includes designated wilderness, the Piedra area, and the wild segment of the Piedra River. MA 2 includes the existing RNAs, special botanical areas (SBAs), Chimney Rock National Monument, and Falls Creek Archeological Area. The MA 4 allocation in Alternative A was applied to areas under the current LRMP that were allocated to semi-primitive non-motorized recreation areas. MA 5 correlates closely with the areas suitable for timber production and areas that were open to cross-country motorized travel (before the current LRMP was amended). There was no similar category to MA 7 in the current management prescriptions; hence, there are no acres allocated to MA 7 in Alternative A. Lastly, MA 8 includes the McPhee dam and areas of existing and potential downhill ski areas under the current LRMP.

For the most part, the ***type of resources and areas*** allocated to each MA under Alternative A are the same areas and resources allocated under Alternatives B, C, and D. For example, MA 1 applies to wilderness areas, the Piedra Area, and wild segments of suitable WSR under all alternatives; MA 2 applies to most special area designations and unique landscapes, such as RNAs, SBAs, archeological areas, etc.; and MA 8 applies to dams and downhill ski areas. In general MA 5 correlates with lands suitable for timber production and landscapes with a developed road system. The application of MA 4 for Alternatives B, C, and D is applied to scenic byways and other NFS roads valued for their scenery and driving for pleasure, as well as recreation destinations, such as lakes. MA 7 is applied to the areas where public and private lands are intermixed and around communities. MA 3 generally applies to most lands not already allocated for the specific resources and areas that the other MAs define. The primary MA differences among the alternatives include:

- **Management of CRAs:** Consistent with the theme of emphasizing the undeveloped nature of the SJNF, Alternative C allocates nearly all of the CRAs to MA 1 (which is more restrictive than the

Colorado Roadless Rule), whereas Alternatives A, B, and D manage most CRAs as MA 3. (Additionally, in Alternatives B, C, and D there are some portions of CRAs that are designated as MA 4 [e.g., CRAs that are within scenic corridors], MA 7 for areas just outside Pagosa Springs, and MA 2 such as RNA designations.) Hence, Alternative C has the most acres allocated to MA 1.

- **Areas suitable for timber production and MA 5 lands:** All lands suitable for timber production are allocated to MA 5 and include lands that have commercial timber value. With the passing of the Colorado Roadless Rule and its prohibitions on tree cutting and road building, all suitable timber production lands that were within CRAs were removed from all alternatives, resulting in similar acres allocated to MA 5 across the alternatives.
- **Areas suitable for downhill ski area development:** MA 8 varies significantly by alternative due to differences among the alternatives for downhill ski areas. Under the current LRMP, 14,538 acres are identified for downhill ski development. Alternative D is similar to Alternative A, but removes the Wolf Creek Valley and Stoner potential downhill ski areas, managing these areas as MA 3 instead. Alternative B makes the same changes as Alternative D and additionally removes the East Fork potential ski area, which is also a CRA, and instead would manage it as an MA 1. Alternative C would manage most of the downhill ski areas identified in Alternative A as MA 1 to retain their undeveloped character.

2.4.2 Issue 1: Balancing Management between the Ideas of Maintaining “Working Forest and Rangelands” and Retaining “Core Undeveloped Lands”

This issue addresses questions regarding where public lands should be actively managed (e.g., for timber production and mineral development) and which lands should have minimal management, allowing natural processes to shape the landscape (i.e., core undeveloped areas). The three primary activities and uses of actively managed lands on the SJNF and TRFO are timber production, mineral development, and livestock grazing. Roads can be expected in the active MAs, because lands devoted to managing or extracting resources generally require road access. On SJNF lands, MA 5 lands are primarily correlated with areas identified as suitable for timber production, mineral development, access, and where road construction is suitable and anticipated.

Core undeveloped areas provide reserves and refuges to protect native biodiversity and serve as wildlife movement corridors and linkage areas. A majority of the core undeveloped areas or on SJNF lands are within roadless areas identified in the Colorado Roadless Rule. Other undeveloped areas include BLM lands managed for their wilderness characterisitcs, RNAs, and areas recommended for wilderness. Most of the LRMP decisions related to these undeveloped areas are discussed under Issue Three: Special Area Designations. Management of CRAs on SJNF lands is consistent across all alternatives and managed by the Colorado Roadless Rule.

In general, Alternatives A and D emphasize active management and land allocations that maximize goods and services on the SJNF and TRFO, followed by Alternative B. Alternative C favors the retention of core undeveloped lands, where natural processes dominate land management and would yield the least amount of commodity goods and services.

2.4.2.a Lands Suitable for Timber Production and Harvest

Timber suitability is determined through a process established through the NFMA and planning regulations. This winnowing process first identifies lands not suitable for harvest by excluding areas where 1) site conditions preclude tree cover, 2) harvest is prohibited by statute or regulation (e.g., wilderness), 3) irreversible resource damage could occur from timber harvest (e.g., steep or unstable

slopes), and 4) adequate restocking, with trees, following harvest is not assured. Lands remaining after this exclusionary process are deemed “tentatively suitable.” These remaining lands are broken into two classes: 1) lands suitable for timber production (“suitable timberlands”) and 2) “other tentatively suitable lands where timber harvest may occur” for multiple-use objectives other than timber production. Tentatively suitable lands are the same for all alternatives.

The timber sale program quantity (TSPQ) is an estimate of annual average output of timber from the SJNF during the first decade under this LRMP based on expected budget levels, industry capacity, and other public and resource objectives. The TSPQ is a combined program of timber management treatments from USFS lands designated as “suitable for timber production” and other tentatively suitable lands. The SJNF has a program of vegetation management in which timber sales are offered based on capability determined by the Long Term Sustained Yield Capacity, which is defined as the highest uniform wood yield that may be sustained under specified management intensities consistent with multiple-use objectives after stands have reached desired conditions.

Allowable sale quantity (ASQ) is the quantity of timber that may be sold from the area of suitable (for production) land covered by the LRMP; this is also referred to as “chargeable volume;” this is displayed in these LRMP revision documents as an upper threshold, under what might be viewed as a “full” budget, that is, fully meeting timber management goals

There is currently not an active commercial timber program on the BLM lands within the planning area; however, non-commercial products (including post and poles, Christmas trees, and other non-forest products) are available.

Given the adoption of the Colorado Roadless Rule (July 3, 2012), the SJNF removed all CRAs from the lands “suitable for timber production” in all alternatives. This is the primary reason that the acres suitable for timber production are relatively similar for Alternatives A, B, and D (Table 2.4.2). The “total acres where timer harvesting may occur” varies by alternative, due primarily to areas identified for other resource emphasis or special designation, such as recommended for wilderness on the SJNF lands.

Table 2.4.2: Timber Harvest and Production by Alternative

Timber Harvest and Timber Production	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Tentatively suitable (USFS)	722,680	722,680	722,680	722,680
Tentatively suitable (BLM)	29,146	29,146	29,146	29,146
Not suitable for timber production or harvest (USFS)	1,143,357	1,157,816	1,386,816	1,145,625
Not suitable for timber production or harvest (BLM)	476,676	476,323	476,912	476,320
Suitable for timber production (USFS)	308,544	311,949	299,431	314,118
Suitable for timber production (BLM)	0	0	0	0
Other tentatively suitable lands where timber harvest may occur (USFS)	412,933	395,067	178,587	405,090
Other tentatively suitable lands where timber harvest may occur (BLM)	26,956	27,309	26,720	27,312

Timber Harvest and Timber Production	**Alternative A (No Action)**	**Alternative B (Preferred)**	**Alternative C**	**Alternative D**
Total Acres where Timber Harvesting May Occur (USFS)	721,477	707,016	478,018	719,208
Total Acres where Timber Harvesting May Occur (BLM)	26,956	27,309	26,720	27,312
SJNF Timber Program Projections	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Timber: Long-term Sustained-Yield Capacity million cubic feet/million board feet (MMCF/MMBF) (average annual value for first decade)				
Timber production compatible with desired conditions and objectives	8.77/35.86	8.54/35.55	7.96/33.15	8.49/35.38
Other lands (timber harvesting in order to meet resource and area desired conditions and objectives but not for production purposes)	2.05/7.90	1.82/7.03	1.13/0.91	1.97/7.57
Timber Sale Program Quantity MMCF/MMBF (average annual value for first decade)				
Timber production compatible with desired conditions and objectives	1.71/8.57	2.18/10.92	1.99/9.95	2.46/12.29
Other lands (timber harvesting in order to meet resource and area desired conditions and objectives but not for production purposes)	0.21/1.03	0.18/0.91	0.10/0.49	0.20/0.98
Timber: ASQ MMCF/MMBF (average annual value for first decade)				
ASQ	3.7/18.7	4.0/19.9	3.8/18.9	4.0/20.2

2.4.2.b Lands Suitable and Available for Cattle and Sheep Grazing

Alternative A would continue the current allotment status and stocking rates. Alternative B is similar to Alternative A, in that AUMs would change by approximately 2%. Specifically, Alternative B would slightly increase permitted AUMs by combining several vacant custodial BLM allotments with active maintain category BLM allotments. Eleven BLM custodial grazing allotments in the Pagosa unit would be closed due to the difficulties of managing small parcels of public lands within larger private land parcels undergoing subdivision for non-agricultural uses, and remaining unstocked BLM custodial grazing allotments would be closed to improve program administration efficiency. Under Alternative B, acres of suitable grazing lands would not change on NFS lands.

Alternative C reduces grazing opportunities, reduces stocking rates, and closes the most allotments of all the alternatives in order to enhance wildlife, soils, ecosystem restoration, and cultural values. Alternative C achieves this by making currently vacant USFS sheep allotments permanently closed to livestock grazing and closing BLM sheep allotments in the Silverton area to eliminate potential wild and domestic sheep conflicts. Alternative C would also close the BLM Spring Creek allotment located within the Spring Creek Wild Horse HMA and would close custodial BLM allotments to improve public land management efficiency. (Note: any decision to close or stock vacant allotments would be evaluated at the project level.)

Alternative D proposes to increase livestock grazing by offering vacant USFS allotments to qualified operators, stocking rates via restoration activities on improve and maintain category BLM allotments, and AUMs on USFS grazing allotments within those areas where restoration activities are planned. Under Alternative D, acres of suitable grazing lands for cattle would increase by 16% and 3% for

SJNF and BLM lands, respectively, and remain the same as Alternatives A and B for suitable/available grazing lands for sheep (Table 2.4.3).

Table 2.4.3: Livestock Grazing Land Allocations by Alternative

Livestock Grazing	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Livestock Grazing: Permitted AUMs				
Sheep: permitted AUMs (USFS)	6,396	6,396	4,981	11,327
Sheep: permitted AUMs (BLM)	2,073	2,073	16	2,281
Total Sheep AUMs	8,469	8,469	4,997	13,608
Cattle: permitted AUMs (USFS)	102,925	105,809	93,602	139,745
Cattle: permitted AUMs (BLM)	21,070	21,152	14,189	23,734
Total Cattle AUMs	123,995	126,961	107,791	163,479
Livestock Grazing: Suitable and Available Acres				
Sheep: total suitable acres (USFS)	183,733	183,733	122,670	183,733
Sheep: lands available (BLM)	31,973	31,973	2,566	31,973
Total Acres	215,706	215,706	125,236	215,706
Cattle: total suitable acres (USFS)	689,628	689,628	641,456	800,810
Cattle: lands available (BLM)	398,802	388,202	320,214	398,802
Total Acres	1,088,430	1,077,830	961,670	1,199,612

2.4.2.c Lands Open for Locatable Mineral Development

Lands currently withdrawn or segregated from mineral leasing under all alternatives include designated wilderness, the Piedra Area, the Alpine Loop Backcountry Byway, Chimney Rock National Monument, and existing downhill ski areas, administrative sites, and developed recreation areas (e.g., campgrounds). Additionally, Alternative B recommends the wild segments of suitable WSRs and recommended wilderness areas be petitioned for withdrawal. Alternative C recommends the same areas be petitioned for withdrawal as Alternative B and adds the entire Dolores River Canyon, RNAs, lands managed for their wilderness characteristics, and the Mesa Verde Escarpment. Alternative D does not recommend any new lands be petitioned for withdrawal (Table 2.4.4).

Table 2.4.4: Lands Open, Closed, and Recommended for Withdrawal from Locatable Mineral Development by Alternative

Federal Mineral Estate	Alternative A	Alternative B	Alternative C	Alternative D
Open to locatable mineral development (USFS)	1,279,087	1,220,604	751,447	1,279,087
Open to locatable mineral development (BLM)	724,638	711,983	656,579	724,638
Withdrawn (USFS)	502,502	502,502	502,502	502,502
Withdrawn (BLM)	3,557	3,557	3,557	3,557
Petition to withdraw (USFS)	0	58,482	527,640	0
Petition to withdraw (BLM)	0	12,655	68,059	0

2.4.3 Issue 2: Providing Recreation and Travel Management within a Sustainable Ecological Framework

This issue addresses questions about what lands should be made available for recreational motorized or non-motorized travel, including overground and oversnow travel. In general, travel suitability is determined based on the need for administrative access, the goals of providing for various recreational opportunities and reducing user conflicts, the need to provide for resource protection, and in consideration of wildlife habitat needs. The LRMP decision identifies ***areas*** where motorized use is either suitable or not suitable (in USFS terms) and areas that are either open, closed, or limited (in BLM terms). This LRMP/FEIS does not make site-specific, route-by-route designations, such as identifying specific roads or trails that would be open or closed; those decisions are made during travel management planning. For more information about motorized suitability and travel management planning on the SJNF and TRFO, please see the Access and Travel Management section of the LRMP.

2.4.3.a Motorized Suitability and Off-Highway Vehicle Designations

SJNF Overground Motorized Suitability: For overground travel on SJNF lands in Alternative A, all areas are suitable for motorized travel except designated wilderness areas, the Piedra Area, and the wild segment of the Piedra River. Alternative A is based on the 2005 visitor map that was used during public scoping. Alternatives B, C, and D all identify more areas as not suitable for overground motorized use. In general, the changes from Alternative A are a result of making MA 1 lands and areas recommended for wilderness unsuitable, as well as areas identified for resource or habitat emphasis, including some CRAs that currently do not have motorized routes. Areas of greatest difference among the alternatives for overground travel include, but are not limited to, most of the area within the Rico West-Dolores landscape (including Fish Creek, Willow Divide, the Meadows, Bear Creek, and the Rico Mountains), the Hermosa Creek and Beaver Meadows area on the Columbine District, Turkey Springs, Jackson Mountain, and the Trail Ridge areas on the Pagosa District.

Alternative B closes 928,054 acres to overground travel; approximately half of those acres (481,532) are within the wilderness and Piedra areas. Alternative C would make the most areas unsuitable for motorized use (1,133,752), as it has the most MA 1 acres and the most acres recommended for wilderness. Conversely, Alternative D does not recommend any wilderness areas and has the least amount of MA 1 acres; hence, it has more acres available for motorized recreation. Overall, Alternative D closes approximately 273,000 acres more than currently identified in Alternative A.

SJNF Oversnow Motorized Suitability: Alternative A has 883,972 acres open for oversnow motorized travel and 980,860 acres unsuitable. This alternative has the most suitable oversnow acres of all the alternatives and would provide the most suitable motorized recreation opportunities on the mountain passes. Alternative D has approximately 30,000 less suitable acres than Alternative A, including less acres in the Coalbank and Wolf Creek Pass areas. Compared to Alternative A, Alternative B reduces the acres of open to motorized winter use by approximately 91,600 acres. The changes in areas open and closed can best be understood by viewing the Section 3.14, Recreation. In Alternative B the east side of Red Mountain Pass would change to unsuitable and the west side would remain suitable (access from the west side to the suitable area known as US Basin on the east side of the pass would be retained via a motorized route connecting the two areas). The configuration of open and closed areas also changes for Coalbank, Molas, and Wolf Creek Pass in Alternative B. Alternative C allocates the least amount of acres for oversnow motorized use, which correlates with the emphasis on maintaining undeveloped areas and the amount of acres allocated to MA 1, which

prohibits overground and oversnow motorized recreation. In Alternative D, both sides of Red Mountain Pass would be suitable for oversnow motorized travel, as there would be more suitable acres at the other passes than provided by Alternatives B and C.

TRFO OHV area designations year-round: Closed areas in Alternative A on TRFO lands include WSAs, the Snaggletooth area of the Dolores River Canyon, Perins Peak Wildlife Management Area, and Animas Mountain. Limited Areas under Alternative A include Silverton, a portion of Disappointment Valley, and a portion of the Grandview area. All other areas are open to OHV travel under Alternative A on TRFO lands.

The primary difference between Alternative A and the other alternatives on TRFO lands is that nearly all of the currently designated open areas under Alternative A would be changed to limited to existing routes or limited to designated routes under Alternatives B, C, and D. The limited OHV designation compliments the upcoming travel management planning on TRFO lands, in which route designations and season of use would be determined. It also compliments agency direction to limit cross-country travel and designated routes. Acres limited to designated routes are the same for Alternatives B, C, and D.

Under Alternative B most of the TRFO would be designated as limited to existing routes. The closed areas would be similar to Alternative A, with the addition of closing lands managed for their wilderness characteristics. Two small play areas totaling 23 acres within the Cortez Special Recreation Management Area (SRMA) would be designated open to cross-country travel.

Alternative C has the most closed acres, including WSAs, lands managed for their wilderness characteristics, and the Mesa Verde Escarpment. The rest of the area is designated as limited to designated or limited to existing routes under Alternative C; there are no open areas under Alternative C.

Alternative D has the same closed acres as Alternative A, except Animas Mountain would be limited, not closed. Alternative D would have the same open areas (23 acres) as Alternative B, and the rest of the area would be designated as limited to designated or existing routes (Table 2.4.5).

Table 2.4.5: Motorized Travel Suitability and Recreation Land Allocations by Alternative

Motorized Suitability and Recreation	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
SJNF Motorized Travel over Ground (acres)				
USFS not suitable	482,019	928,054	1,133,752	755,538
USFS suitable areas	896,400	632,500	448,992	759,602
USFS suitable opportunity areas	486,413	304,278	282,088	349,692
Total	1,864,832	1,864,832	1,864,832	1,864,832
Motorized Travel over Snow (acres)				
USFS not suitable areas	980,860	1,072,520	1,277,808	1,008,741
USFS suitable areas	883,972	792,312	587,024	856,091
Total	**1,864,832**	**1,864,832**	**1,864,832**	**1,864,832**
TRFO Motorized Travel Year-round				
BLM closed	70,602	73,823	104,523	59,758
BLM limited	69,254	429,782	399,104	443,846
BLM open	363,771	23	0	23
Total	**503,627**	**503,628**	**503,627**	**503,627**

2.4.3.b Special Recreation Management Areas (BLM only)

Current management (Alternative A) includes two SRMAs—Dolores River Canyon and Silverton. Alternative A includes approximately 17,000 acres more in the Dolores River Canyon SRMA than the other alternatives, which are within the Dolores River Canyon WSA. Hence, Alternatives B, C, and D stop the SRMA at the WSA boundary.

Alternatives B and C have the same SRMA designations including the two existing SRMAs (Dolores River Canyon and Silverton) and adds two more SRMAs for recreation opportunities around Durango and Cortez.

Alternative D has the greatest amount of acres allocated for SRMAs (if not including the Dolores River Canyon WSA that Alternative A has). Similar to Alternatives B and C, it includes the two existing SRMAs (Dolores River Canyon and Silverton) and adds the Durango and Cortez SRMAs. However, the Durango SRMA is larger than identified in Alternatives B and C because it includes Perins Peak parcels as part of the SRMA (Table 2.4.6). See Maps 36 through 39 in Volume III. Appendix V for a depiction of SRMAs proposed under each alternative.

Table 2.4.6: Special Recreation Management Areas by Alternative

SRMAs	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Cortez SRMA	0	8,710	8,710	8,710
Dolores River SRMA	50,222*	33,435	33,435	33,435
Durango SRMA	0	3,632	3,632	5,145
Silverton SRMA	44,888	44,888	44,888	44,888
Total	**95,110**	**90,665**	**90,665**	**92,178**
* The SRMA boundary in Alternative A includes acres within the Dolores River Canyon WSA. The SRMA boundary in Alternatives B, C, and D does not include the acres within the WSA.				

2.4.3.c Downhill Ski Areas

Alternative A downhill ski acreage allocation is outdated, in that it includes areas that were identified more than 20 years ago that have never been developed and that have gone defunct since the current plans were written. Given the unfeasible ski area allocations in Alternative A, Alternative D recommends the most acres for downhill skiing. It includes the current Durango Mountain Resort and Silverton areas, and identifies two new polygons that would expand the Wolf Creek ski area onto the SJNF, totaling (821 acres). Alternative D would also retain the East Fork potential downhill ski area. Alternative B includes the current Durango Mountain Resort and Silverton ski areas, and identifies the two polygons to expand the Wolf Creek ski area onto the SJNF. The current permitted downhill ski area boundary for Purgatory ski area is kept the same in Alternatives B and D. This boundary includes what is developed and room for expansion to the north. The Wolf Creek ski area expansion is not found suitable under Alternative C. Additionally, the Durango Mountain Resort permitted ski area boundary is reduced in Alternative C to include just the currently developed area (Table 2.4.7).

Table 2.4.7: Downhill Ski Area Allocations by Alternative

SRMAs and Downhill Ski Areas	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Downhill Ski Areas				
Durango Mountain Resort (existing)–SJNF	5,593	5,593	2,149	5,593

SRMAs and Downhill Ski Areas	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Downhill Ski Areas				
Wolf Creek ski area expansion (potential)–SJNF*	60	821	60	821
East Fork (potential)–SJNF	5,009	0	0	5,009
Stoner (defunct)–SJNF	276	0	0	0
Wolf Creek Valley (defunct)–SJNF	2,412	0	0	0
Silverton ski area (existing)–BLM	1,300	1,300	1,300	1,300
Total Downhill Ski Areas	14,491	7,714	3,350	12,596
*All alternatives reflect 60 acres of existing Wolf Creek ski area facilities and equipment that is actually on the SJNF and not the Rio Grande National Forest (e.g., explosives cache, miscellaneous equipment, etc.)				

2.4.3.d Recreation Opportunity Spectrum

Changes between Alternative A recreation opportunity spectrum (ROS) and the action alternatives were made primarily to correlate more closely with motorized suitability and OHV designations and to represent foreseeable recreation opportunities across SJNF and TRFO lands. For example, the greatest difference in ROS acreage on SJNF lands is the difference between semi-primitive non-motorized and semi-primitive motorized ROS, which correlates with suitable and unsuitable allocations for Alternatives B, C, and D (Table 2.4.8). Primitive wilderness ROS on the SJNF in Alternatives B, C, and D is due to allocating wilderness and the Piedra to this classification. Similarly, on TRFO lands, the primitive ROS category increased in Alternatives B, C and D due to allocating WSAs to this classification. Please see the Recreation section of the LRMP for an explanation of the different ROS classes.

Table 2.4.8: Recreation Opportunity Spectrum Acres by Alternative

Recreation Opportunity	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
SJNF Summer ROS				
Primitive wilderness	0	481,532	481,532	481,532
Primitive	490,173	2,620	513,756	0
Semi-primitive non-motorized	369,118	435,171	137,885	278,360
Semi-primitive motorized	93,738	448,638	274,643	512,464
Roaded natural	881,687	495,545	455,615	591,076
Rural	30,115	1,325	1,400	1,399
Total SJNF Summer ROS	**1,864,831**	**1,864,831**	**1,864,831**	**1,864,831**
SJNF Winter Recreation Opportunity Spectrum				
Primitive wilderness	481,035	481,532	481,532	481,532
Primitive	0	2,605	527,174	0
Semi-primitive non-motorized	437,315	545,132	243,329	463,601
Semi-primitive motorized	287,471	514,037	268,378	319,863
Roaded natural	657,367	318,659	344,021	596,881
Rural	1,643	2,866	397	2,954
Total SJNF Winter ROS	**1,864,831**	**1,864,831**	**1,864,831**	**1,864,831**
TRFO Recreation Opportunity Spectrum Year-round				
Primitive	0	55,729	55,729	55,730
Semi-primitive non-motorized	61,274	19,881	23,840	19,724
Semi-primitive motorized	319,989	331,366	343,806	331,575
Roaded natural	75,876	95,819	79,420	95,765
Rural	46,490	834	834	834
Total BLM	**503,629**	**503,629**	**503,629**	**503,629**

2.4.3.e Visual Resource and Scenic Integrity Management Objectives

Visual resource management (VRM) objectives on TRFO lands and scenic integrity objectives (SIOs) on the SJNF vary by alternative based primarily on the theme of each alternative. For example on the SJNF, very high SIO acres are the greatest in Alternative C due to great amount of acres recommended for wilderness designation (Table 2.4.9). Similarly, the VRM II acres are greatest Alternative C, as that alternative emphasizes the natural preservation over commodity production of lands. Alternative D emphasizes commodity production, which could potentially alter the visual resources of the landscape; hence Alternative D allocates more acres to VRM Classes III and IV and low and moderate SIOs. Low SIO and VRM Class IV represent the greatest difference among the alternatives. Low SIO and VRM Class IV acres in Alternative B represent areas where timber harvest and vegetation management would be emphasized on the Dolores District (SJNF), oil and gas development in the HD area of the Columbine District (SJNF), and U.S. Department of Energy (DOE) lands on the TRFO. Alternative D allocates the greatest amount of Low SIO and VRM IV acres, primarily due to the oil and gas development anticipated in the Paradox Leasing Analysis Area (PLAA) on both SJNF and TRFO lands.

Table 2.4.9: Visual Resource Management and Scenic Integrity Objectives by Alternative

VRM and SIO	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
SJNF Scenic Integrity Objectives				
Very low	3,509	0	0	0
Low	107,398	113,005	5,243	330,160
Moderate	396,951	522,319	498,209	256,341
High	871,086	625,731	347,766	775,737
Very high	485,887	603,767	1,013,572	502,554
Total SJNF	**1,864,831**	**1,864,831**	**1,864,832**	**1,864,832**
TRFO Visual Resource Management Objectives				
VRM I	0	57,922	57,592	57,494
VRM II	0	169,277	354,264	235,634
VRM III	0	267,296	90,572	108,372
VRM IV	0	9,135	1,201	102,129
Unclassified	503,629	0	0	0
Total BLM	**503,629**	**503,629**	**503,629**	**503,630**

2.4.4 Issue 3: Management of Special Area Designations and Unique Landscapes

This issue reflects the question about which areas should be recommended for special designations or emphasize specific resource management or protections. Special area designations are described below and compared by alternative.

In continuing current management, Alternative A would not recommend any new areas for special designation; it would only continue to manage the areas currently identified, including:

- WSR segments of the Dolores, West Dolores, Los Pinos, and Piedra Rivers found suitable under the current plan;
- the Anasazi Cultural Area ACEC on TRFO lands;
- the Williams and Narraguinnep RNAs on SJNF lands,

- the Falls Creek and Chimney Rock Archeological Areas on SJNF lands
- the O'neal Hill SBA
- the Spring Creek Wild Horse HMA; and
- the Perins Peak Wildlife Management Area.

2.4.4.a Wilderness Recommendations on San Juan National Forest Lands

Alternative A does not recommend any new wilderness. Alternative B recommends the following four areas for wilderness on SJNF lands, totaling 54,886 acres: the west side of the Hermosa CRA, the Lizard Head adjacent CRA, portions of the Weminuche adjacent CRAs (Elk Park and Monk Rock), and portions of the Turkey Creek CRA. The other CRAs would be managed to retain their roadless character in accordance with the Colorado Roadless Rule. Under Alternative C, all CRAs that meet the available and capable requirements for wilderness are proposed for wilderness (approximately 532,400 acres) (Table 2.4.10).

Table 2.4.10: Recommended Wilderness Areas by Alternative and Already Designated Areas

Specially Designated Lands	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Wilderness, WSAs, and Recommended Wilderness				
Wilderness acres - Congressionally designated (USFS)	420,522	420,522	420,522	420,522
Piedra Area (USFS)	60,341	60,341	60,341	60,341
WSAs (BLM)	56,576	56,576	56,576	56,576
Recommended Wilderness (USFS) (acres)				
Fish Creek	0	0	13,537	0
Storm Peak	0	0	57,623	0
Ryman	0	0	8,665	0
Lizard Head, adjacent	0	2,632	5,558	0
Blackhawk Mountain	0	0	17,545	0
Hermosa	0	50,850	149,402	0
San Miguel	0	0	65,061	0
West Needle	0	0	4,378	0
East Animas			16,883	
Baldy	0	0	20,032	0
Florida River			5,726	
Runlett Park	0	0	5,600	0
HD Mountains			0	
Piedra Area, adjacent	0	0	39,230	0
Graham Park			17,325	
Weminuche, adjacent	0	740	20,827	0
Turkey Creek	0	664	25,311	0
Treasure Mountain	0	0	22,502	0
South San Juan, adjacent	0	0	34,964	0
Winter Hills/Service Berry	0	0	5,100	0
Total Recommended Wilderness Acres (USFS)	**0**	**54,886**	**535,269**	**0**

2.4.4.b Lands with Wilderness Characteristics on TRFO lands

The inventory of lands with wilderness characteristics (see Volume III, Appendix O—Lands with Wilderness Characteristics) identified 36,574 acres that had wilderness characteristics. Alternative A does not have any lands with wilderness characteristics identified. Alternative B recommends managing an area in Coyote Wash and an area near the Snaggletooth section of the Dolores River for their wilderness characteristics. Alternative C recommends managing all of the areas found to have wilderness values for their wilderness characteristics, with some minor exceptions. Alternative D does not recommend that any of the areas be managed for their wilderness characteristics (Table 2.4.11).

Table 2.4.11: Lands with Wilderness Characteristics by Alternative

	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Lands managed for wilderness characteristics	N/A	11,867	36,574	0

2.4.4.c Suitable Wild and Scenic Rivers

Alternative A would continuing to manage river segments found suitable under the current plan for WSR status, including the Dolores, West Dolores, Los Pinos, and Piedra Rivers.

Alternative B finds 12 river segments, totaling approximately 356 miles, suitable for inclusion in the National Wild and Scenic Rivers System. Under Alternative C, 24 river segments, totaling approximately 534 miles, would be considered suitable for addition to the National Wild and Scenic Rivers System. This total includes all segments considered eligible due to their outstandingly remarkable values (ORVs) and free-flowing character. Consistent with its management theme, Alternative D does not make any river segment suitable for WSR status (Table 2.4.12).

Table 2.4.12: Miles of Recommended Suitable Wild and Scenic Rivers by Alternative

Wild and Scenic River Segments	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Dolores River				
Dolores, above McPhee	0	0	56	0
Dolores McPhee to Bedrock	108	108	108	0
Rio Lado	0	0	3	0
West Dolores	34	0	34	0
Summit Canyon	0	0	12	0
Coyote Wash	0	8	8	0
McIntyre Canyon	0	0	6	0
Bull Canyon	0	0	6	0
Animas River				
Bakers Bridge to Sultan Creek	0	27	27	0
Sultan Creek to Silverton	0	0	4	0
Mineral Creek	0	9	9	0
Cement Creek	0	0	8	0
Cinnamon Creek	0	0	2	0
Maggie Gulch	0	0	5	0
South Fork Mineral Creek	0	7	7	0
West Fork Animas/California Gulch	0	0	3	0

Wild and Scenic River Segments	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Hermosa Creek and Tributaries				
Hermosa Creek and tributaries	0	62	62	0
Los Pinos River				
Los Pinos and tributaries above Vallecito	54	54	54	0
Vallecito Creek	0	0	17	0
Piedra River				
North of Hwy 160 to Forks	22	22	22	0
South of Hwy 160 to SJNF boundary (Chimney Rock area)	0	0	8	0
East Fork Piedra River				
North of wilderness boundary	9	9	9	0
South of wilderness boundary	7	0	7	0
Middle Fork Piedra River	19	19	19	0
San Juan River				
West Fork San Juan River	0	11	17	0
Wolf Creek and Fall Creek	0	0	8	0
East Fork San Juan River	0	13	13	0
Total Suitable WSR Segment Miles	**253**	**350**	**534**	**0**
Total Suitable WSR River Segments	**7**	**12**	**27**	**0**

2.4.4.d Areas of Critical Environmental Concern

Alternative A would continue to manage the existing Anasazi Cultural Area ACEC. Under Alternative B, one new ACEC, Gypsum Valley, would be designated and 941 acres of the Anasazi Cultural Area ACEC would continue to be managed as an ACEC (the size of this ACEC changed from Alternative A due to removing the portion of the area that has a developed gravel pit). Alternative C includes the same ACECs as Alternative B, but adds Silveys Pocket and Grassy Hills. All of these areas were identified as potential conservation areas by the Colorado Natural Heritage Program due to their significant biodiversity (Table 2.4.13).

Table 2.4.13: Areas of Critical Environmental Concern by Alternative

ACECs (BLM)	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Anasazi Cultural Area	1,160	941	941	0
Gypsum Valley	0	13,333	13,333	0
Silveys Pocket	0	0	707	0
Grassy Hills	0	0	420	0
Total ACEC Acres	**1,160**	**14,274**	**15,401**	**0**
Total ACEC Areas	**1**	**2**	**4**	**0**

2.4.4.e Research Natural Areas

Alternative A would continue to manage the two existing RNAs—Narraguinnep and Williams. In addition to the two existing RNAs, eight new RNAs totaling 54,493 acres would be designated under Alternative B. Alternative C would continue managing the two existing RNAs and designate nine new RNAs, totaling 69,141 acres. Alternative D proposes three new RNA areas to the existing two areas for a total of 15,277 acres (Table 2.4.14).

Table 2.4.14: Research Natural Areas by Alternative

Research Natural Areas (USFS)	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Electra	0	2,455	2,455	2,455
Grizzly Peak	0	3,256	4,676	0
Hermosa	0	15,469	15,469	0
Martinez Creek	0	1,305	1,305	0
Hidden Mesas	0	3,132	3,132	3,132
Navajo River	0	7,183	7,183	7,183
Needles Mountain	0	0	12,900	0
Piedra	0	5,976	5,976	0
Porphyry Gulch	0	11,840	11,840	0
Narraguinnep (existing)	1,971	1,971	1,971	1,971
Williams Creek (existing)	486	486	486	486
Total RNA Acres	2,457	53,073	67,393	15,227
Total RNA Areas	2	10	11	5

2.4.4.f Special Botanical Areas

Alternative A would continue to manage the O'Neal Hill SBA. In addition, Alternatives B, C, and D make the Chattanooga Fen an SBA. Alternatives B and C include management direction to retain and protect approximately 4,800 acres with old growth ponderosa pine (*Pinus ponderosa*) in the Dolores District. Under Alternative D these areas would not have specific management direction, but would be managed per the LRMP Terrestrial Ecosystem plan components (see Volume II, LRMP) (Table 2.4.15).

Table 2.4.15: Special Botanical Areas and Old Growth Recruitment Areas by Alternative

Botanical Areas (USFS)	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
O'Neal Hill SBA	328	276	276	276
Chattanooga Fen SBA	0	59	59	59
Old Growth Recruitment Areas (USFS)	**Alternative A (No Action)**	**Alternative B (Preferred)**	**Alternative C**	**Alternative D**
Boggy Old Growth Recruitment Area	0	2,534	2,534	0
Smoothing Iron Old Growth Recruitment Area	0	2,314	2,314	0

2.4.4.g Wildlife Management Areas

The Perins Peak Wildlife Management Area is included in all alternatives. However, under Alternatives B, C, and D, the Animas Mountain portion is removed and made part of the SRMA. The wildlife values and especially winter closures are included in the SRMA direction specific for the Animas Mountain (i.e., managing winter closures is a key part of the SRMA direction).

Alternative C identifies an additional wildlife management area to protect the sage-grouse (*Centrocercus urophasianus*) habitat adjacent to the Willow Creek State Wildlife Area. Under Alternatives B and D these parcels would not have specific habitat management, but would be managed per the LRMP Terrestrial Wildlife plan components (see Volume II, LRMP) (Table 2.4.16).

Table 2.4.16: Wildlife Management Areas by Alternative

Wildlife Management Areas (BLM)	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Perins Peak Wildlife Management Area	3,787	2,274	2,274	2,274
Willow Creek Wildlife Management Area	0	0	876	0

2.4.4.h Wild Horse Herd Management Areas

The Spring Creek Wild Horse HMA is included in all alternatives with the same management direction under all alternatives (see Volume II, LRMP, Chapter 3 for more information) (Table 2.4.17).

Table 2.4.17: Wild Horse Herd Management Area

Wild Horse Herd Management Areas (BLM)	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Spring Creek Wild Horse HMA	20,983	20,983	20,983	20,983

2.4.4.i Heritage and Cultural Area Designations

On SJNF lands, the Chimney Rock National Monument and Falls Creek Archeological Areas would be managed the same under all alternatives. On TRFO lands, Alternatives B and C would manage the Mesa Verde Escarpment area to protect cultural values. Under Alternatives A and D, Mesa Verde Escarpment would not have specific management direction, but would be managed per the LRMP Heritage Resource components (see Volume II, LRMP) (Table 2.4.18).

Table 2.4.18: Heritage and Cultural Designations

Archaeological Areas (USFS and BLM)	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Falls Creek Archaeological Area (USFS)	1,504	1,504	1,504	1,504
Chimney Rock National Monument (USFS)	4,726	4,726	4,726	4,726
Mesa Verde Escarpment (BLM)	0	7,373	7,373	0

2.4.5 Other LRMP Decisions

2.4.5.a Lands Available for Disposal

Since the current LRMP was developed, approximately 900 acres have been disposed of; hence, the total acres identified for disposal in Alternative A are fewer than the other alternatives. Alternatives B and D identify all the parcels in Alternative A and more; primarily most of the isolated, dispersed parcels on TRFO lands are identified for disposal (Table 2.4.19). Alternative C identifies the least amount of acres for disposal, in that it would retain more parcels that are adjacent to other public lands or conservation easements, as well as parcels that may contain eligible cultural sites. See Maps 44 through 47 in Volume III, Appendix V for lands available for disposal under each alternative.

Table 2.4.19: TRFO Lands Available for Disposal

Lands Available for Disposal,	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
Acres available for disposal	10,469	15,327	8,004	15,327

2.4.5.b Right-of-way Exclusion and Avoidance Areas

With regard to areas of right-of-way (ROW) corridors for pipelines, utilities, communication, etc., the LRMP makes decisions about which resources or areas should be excluded (areas that are not available for location of ROWs under any conditions) or avoided (areas to be avoided but may be available for location of ROWs with special conditions). The resources excluded or avoided are the same for all alternatives; however, the acres identified as exclusion and avoidance areas vary by alternative because of the different land allocations for the resourced (e.g., recommended RNAs and WSR have different acres allocated by alternative).

Exclusion areas on TRFO lands include WSAs and recommended suitable WSR (wild segments only); avoidance areas include lands managed for wilderness charateristics, the Anasazi Culture Area ACEC, Perins Peak Wildlife Management Area, the Dolores River Canyon, the Mesa Verde Escarpment, and VRM II scenery classified lands.

Exclusion areas on SJNF lands include wilderness, recommended wilderness, the Piedra Area, recommended suitable WSR (wild segments only), RNAs, and areas allocated to MA 1; avoidance areas include upper tier CRAs, SBAs, Chimney Rock National Monument, Falls Creek Archeological Area, and high SIO scenery classified lands.

ROW avoidance and exclusion areas for both the SJNF and TRFO are summarized in Table 2.4.20.

Table 2.4.20: Right-of-way Avoidance and Exclusion Areas

Avoidance and Exclusion Areas	Alternative A (No Action)	Alternative B (Preferred)	Alternative C	Alternative D
SJNF exclusion acres	514,760	647,263	1,068,710	505,900
TRFO exclusion acres	68,139	69,659	70,049	56,867
Total Exclusion Acres	**582,899**	**716,922**	**1,138,759**	**562,767**
SJNF avoidance acres	1,030,769	787,462	509,497	937,468
TRFO avoidance acres	37,691	232,351	439,984	273,129
Total Avoidance Acres	**1,068,460**	**1,019,813**	**949,481**	**1,210,597**

2.4.6 Issue 4: Management of Oil and Gas Leasing and Development

This issue reflects the question about where energy development should take place and how it should be done to best balance the extraction of oil and gas with the protection of other resources and values. The LRMP and USFS oil and gas leasing availability decisions made in this plan revision and FEIS identify areas that would be made available for oil and gas leasing and development on NFS and BLM public lands, and the leasing stipulations that would apply to new leases.

The leasing alternatives complement Alternatives A, B, C, and D described earlier by incorporating lease stipulations that are consistent with the desired conditions and goals of each alternative. An alternative that allows no leasing of NFS lands within the planning area is provided consistent with the requirements of 36 CFR 228.102(c)(2). A No Leasing Alternative is also analyzed for BLM public lands, including split estate lands, in order to provide a consistent set of alternatives across the public lands administered by the USFS and BLM.

All lands under lease as of the date of the revised LRMP are managed under their existing terms; the revised oil and gas leasing availability decisions do not change or limit the terms of the valid existing rights conveyed by the leases. Existing leases are concentrated in the San Juan Basin and Paradox Basin portions of the SJNF and TRFO. Given the that these leases provide for existing rights, the revised LRMP and USFS oil and gas leasing availability decision provides for where and how oil and gas leasing development may occur on future leases only. If an existing lease expires, then such lands would be subject to the leasing decisions in the revised LRMP.

The lands most likely to be leased if made available are currently unleased lands with moderate or high potential. Within the planning area, lands are considered available for leasing, unless they are specifically withdrawn or administratively not available for lease.

- **Lands Withdrawn:** This legal classification refers to land designations made by the USDI and/or Congress that preclude the appropriation and disposal of federally owned mineral resources under the Mineral Leasing Act of 1920, subject to valid existing rights. Minerals held under valid existing rights may still be extracted. For all alternatives and the No Leasing Alternative, the lands withdrawn from mineral leasing include the designated wilderness areas—Lizard Head, Weminuche, and South San Juan—and the Piedra Area. Combined they total 480,863 acres on SJNF lands.
- **Lands Administratively Not Available:** This classification applies to lands that the Authorized Officer has determined should not be leased for oil and gas based on potential for oil and gas occurrence and development, environmental concerns that cannot be resolved, and/or other conflicting uses of USFS or BLM public lands. This designation would apply only to lands not already withdrawn from leasable mineral appropriation. Within the SJNF and TRFO, four resource areas common to all alternatives have been identified as administratively not available for oil and gas leasing because leasing would not be compatible with the desired conditions for such lands:
    - Wild segments of rivers suitable for WSR designation are administratively not available in all alternatives for lease for the purpose of protecting their suitable WSR status.
    - BLM WSAs are administratively not available for lease in all alternatives for the purpose of ensuring that the wilderness characteristics are protected until Congress acts to designate them for wilderness or release them from their WSA status.
    - USFS areas recommended for wilderness are also administratively not available for lease. The acreage varies by alternative because the acres recommended for wilderness vary by alternative.
    - Chimney Rock National Monument, Anasazi, and Falls Creek Archeological Areas are administratively not available for lease in all alternatives for the purpose of protecting the outstanding archeological values and landscape features that are integral to each sites' integrity of setting and feeling.

  Alternative C would make additional areas not available for lease; they are described under Alternative C below (see Section 2.4.6c).
- **Lands Available for Leasing:** This classification applies to lands that the Authorized Officer has determined to make available for lease based on potential for oil and gas occurrence and development, environmental factors, and/or other uses disclosed in this FEIS.

  For lands available for leasing, standard lease terms apply and further stipulations may be applied as necessary to a lease parcel to specify how leasing and subsequent development would occur. In general, stipulations are applied to minimize adverse impacts specific to air,

water, land, visual, cultural, and biological resources, and other land uses. The stipulation definitions below describe how leasing would occur:

- **No Surface Occupancy (NSO):** Use or occupancy of the land surface for fluid mineral (oil and gas) exploration or development is prohibited to protect identified resource values. However, oil and gas under lands affected by NSO stipulation are legally available for extraction if extraction can be accomplished without occupying the surface (such as through directional drilling or otherwise accessing the reservoir from adjacent lands). Technological limitations and higher cost will affect the recovery of these resources, but they are available.
- **Controlled Surface Use (CSU):** Use or occupancy of the land surface for fluid mineral (oil and gas) exploration or development is allowed but identified resource values require special operational constraints that may modify lease rights. A CSU stipulation allows the SJNF or TRFO to require that a proposed facility or activity be relocated from the proposed location, or otherwise modified if necessary to achieve the desired level of protection. CSU provides operating guidance, but does not substitute for NSO or timing limitation (TL) stipulations. CSU allows year-round occupancy and accessibility to leased lands while providing mitigation of effects on other resources.
- **Timing Limitations (TL):** Use or occupancy of the land surface for fluid mineral (oil and gas) exploration or development is prohibited during a specified period of the year. The scope of the TL stipulation goes beyond ground-disturbing activities to encompass any source of protracted or high-intensity disturbance that could interfere with normal wildlife behavior and adversely affect habitat use. The limitation is applied annually for a specified period. The TL stipulation does not apply to the operation and maintenance of production facilities unless the analysis demonstrates the continued need for such mitigation and that less stringent project-specific mitigation measures (such as Conditions of Approval [COAs]) would not be sufficient. The TL stipulation provides for partial accessibility for a portion of the year and maintains the potential for extraction of oil and gas, but may increase costs due to timing constraints (such as a short operating season).
- **Standard Lease Terms:** All SJNF and TRFO oil and gas leases are subject to standard lease terms. These are the least restrictive terms under which an oil and gas lessee may operate. They require operators of oil and gas leases to minimize adverse impacts to air, water, land, visual, cultural, and biological resources and other land uses and users, and to comply with all applicable laws, regulations and formal orders of the agency managing the leased lands.

Table 2.4.21 details the lands available and not available for lease by alternative. Additionally, the acres of NSO, CSU, TL and standard lease terms are provided. Stipulations may overlap on lands available for lease, e.g., there may be TL and NSO applied to the same acres. Hence, the total for stipulations would be greater than the total lands available for lease.

Table 2.4.21: Oil and Gas Leasing Availability by Alternative on National Forest System and Bureau of Land Management Lands

Jurisdiction	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
USFS					
Federal mineral acres	1,863,402	1,863,402	1,863,402	1,863,402	1,863,402
Acres withdrawn from leasing	509,954	509,954	509,954	509,954	509,954

Jurisdiction	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
Acres administratively not available for leasing	16,357	73,636	644,113	14,896	1,353,448
Acres available for leasing	1,337,090	1,279,811	709,335	1,338,551	0
NSO	848,806	876,266	547,642	666,105	0
CSU	513,893	882,532	391,150	1,033,242	0
TL	783,302	527,489	157	45,463	0
Standard lease terms	177,162	143,722	129,069	210,570	0
BLM					
Federal mineral acres	503,466	503,466	503,466	503,466	503,466
Acres withdrawn from leasing	0	0	0	0	0
Acres administratively not available for leasing	62,437	62,570	161,637	56,916	503,466
Acres available for leasing	441,030	440,896	341,829	446,550	0
NSO	132,713	194,290	318,601	98,486	0
CSU	35,948	401,232	300,504	406,487	0
TL	343,440	321,435	64	28,679	0
Standard lease terms	48,344	22,734	16,729	35,570	0
Federal Subsurface					
Federal mineral acres	319,957	319,957	319,957	319,957	319,957
Acres withdrawn from leasing	0	0	0	0	0
Acres administratively not available for leasing	0	0	0	0	319,957
Acres available for leasing	319,957	319,957	319,957	319,957	0
NSO	36,041	88,548	197,478	34,565	0
CSU	23,705	214,839	171,786	214,665	0
TL	167,189	161,301	0	461	0
Standard lease terms	128,016	82,233	110,718	104,039	0

2.4.6.a Alternative A – Oil and Gas Leasing Availability

Alternative A represents the continuation of current BLM and USFS leasing decisions (Table 2.4.22). This direction is contained in the BLM Colorado Oil and Gas Leasing and Development EIS (January 1991), the San Juan/San Miguel Resource Management Plan (BLM 1985) and the San Juan National Forest Land and Resource Management Plan (USFS 1983), as amended. In total, 2,098,077 acres are available for leasing and 78,794 acres are not available for leasing (Volume III, Appendix V, Maps 49, 53, 57). The lands not available for lease in Alternative A include WSAs and the wild segments of the Dolores River found suitable for WSR status on TRFO lands. On the SJNF, lands not available for lease include Chimney Rock National Monument and the wild segments of WSR segments. Of the combined SJNF and TRFO mineral estate, Alternative A makes 78% of the lands available for lease. Of the lands available, 17% are managed with standard lease terms and 83% are stipulated with NSO, CSU, or TL.

Table 2.4.22: Oil and Gas Leasing Availability by Mineral Estate Owner for Alternative A

Planning Area	USFS	BLM	Federal Subsurface	Total
Federal mineral acres	1,863,402	503,466	319,957	2,686,825
Acres withdrawn from leasing	509,954	0	0	509,954
Acres administratively not available for leasing	16,357	62,437	0	78,794

Planning Area	USFS	BLM	Federal Subsurface	Total
Acres available for leasing	1,337,090	441,030	319,957	2,098,077
NSO	848,806	132,713	36,041	1,017,560
CSU	513,893	35,948	23,705	573,546
TL	783,302	343,440	167,189	1,293,931
Standard lease terms	177,162	48,344	128,016	353,522

2.4.6.b Alternative B – Oil and Gas Leasing Availability

Under Alternative B, approximately 2,040,798 acres are available for lease and 136,073 acres are not available for lease. There is only a 57,279-acre difference in the lands available for lease between Alternatives A and B. The additional lands not available for lease in Alternative B are all on SJNF lands and include additional wild segments of WSR and archaeological National Register Districts (Volume III, Appendix V, Maps 50, 54, 58). Lands not available for lease have the following mineral development potential.

- WSAs (BLM): totaling 55,400 acres are located within no potential areas (10%), moderate potential areas (35%), and high potential areas (55%).
- Wild segments of suitable WSR total approximately 49,050 acres, of which 26% are within high potential areas, 8% are within moderate potential areas, and the majority (66%) are within low or no potential areas.
- The Falls Creek and Anasazi Archaeological Areas and Chimney Rock National Monument total approximately 21,500 acres on SJNF lands, of which 2% are within low potential areas, 27% are within moderate potential areas, and 71% are within and high potential areas.

An NSO stipulation would be applied to approximately 1,097,527 acres, or approximately 50% of the lands available for leasing.

- Approximately 566,100 acres of NSO stipulations are assigned to roadless areas, a majority of which (66%) occur within no to low potential areas and 34% in moderate to high potential areas.
- NSO stipulations prescribed to protect sensitive soils and steep slopes comprise an additional 172,100 acres, of which 43% occur in no to low potential areas and 56% occur in moderate potential areas.
- Recreation-related NSO stipulations (developed recreation and administrative sites, MA 8 designations on SJNF lands, national scenic byways, and high scenic integrity areas) comprise approximately 553,924 acres, 68% of which occur in no to low potential areas and 32% in moderate potential areas.
- The remaining Alternative B NSO stipulation areas include riparian areas and related water bodies, critical wildlife habitat, the Dolores River Canyon, cultural areas, lands managed for wilderness charateristics, state wildlife areas, SBAs, threatened and endangered species habitat, WSR scenic segments, and existing and proposed RNAs. These areas occur across the SJNF and TRFO and range from no to high gas potential.

Table 2.4.23 presents leasing availability and stipulations that would apply to public lands administered by the USFS and BLM in Alternative B.

Table 2.4.23: Oil and Gas Leasing Availability by Mineral Estate Owner for Alternative B

Planning Area	USFS	BLM	Federal Subsurface	Total
Federal mineral acres	1,863,402	503,466	319,957	2,686,825
Acres withdrawn from leasing	509,954	0	0	509,954
Acres administratively not available for leasing	73,636	62,437	0	136,073
Acres available for leasing	1,279,811	441,030	319,957	2,040,798
NSO	876,266	132,713	88548	1,097,527
CSU	882,532	35,948	214,839	1,133,319
TL	527,489	343,440	161,301	1,032,230
Standard lease terms	143,722	48,344	82,233	274,299

2.4.6.c Alternative C – Oil and Gas Leasing Availability

Alternative C has the least amount of lands available for lease of all the alternatives, with the exception of the No Leasing Alternative. Approximately 1,371,000 acres of the planning area would be available for lease and 805,750 acres would be not available for lease (Volume III, Appendix V, Maps 51, 55, 59).

Lands that are available for lease in the other alternatives, but not available in Alternative C, include Colorado Roadless Areas, lands managed for wilderness charateristics, the Chimney Rock viewshed, all federal mineral estate acres within state wildlife areas, proposed archeological National Register Districts, existing and proposed RNAs, the Dolores River Canyon, proposed occupied critical habitat for Gunnison sage-grouse (*Centrocercus minimus*), and municipal watersheds and public water supply areas.

Areas that are either withdrawn or administratively not available for lease have the following oil and gas resource potential:

- Recommended wilderness (USFS) and WSAs (BLM): approximately 627,434 acres including no potential areas (10%), low potential areas (52%), moderate potential areas (29%), and high potential areas (9%).
- Recommended WSR: approximately 56,300 acres including no potential areas (54%), low potential areas (16%), moderate potential areas (7%), and high potential areas (23%).
- CRAs (USFS): approximately 566,100 acres including no potential areas (9%), low potential areas (57%), moderate potential areas (29%), and high potential areas (5%).
- Lands managed for wilderness charateristics: 36,574 acres including moderate potential areas (approximately 25%) and high potential areas (approximately 75%).
- Falls Creek and Anasazi Archaeological Areas and Chimney Rock National Monument (USFS): approximately 21,500 acres including low potential areas (2%), moderate potential areas (27%), and high potential areas (71%).
- Viewshed for Chimney Rock: approximately 60,000 acres including no potential areas (9%), low potential areas (5%), moderate potential areas (74%), and high potential areas (12%).
- Proposed National Register Districts: approximately 11,500 acres including high potential areas (99%).

- Existing and proposed RNAs: approximately 67,400 acres including no potential areas (41%), low potential areas (31%), moderate potential areas (25%), and high potential areas (3%).
- Dolores River Canyon: approximately 43,900 acres including moderate potential areas (5%) and high potential areas (95%).
- Municipal watersheds and public water supplies: approximately 26,900 acres including no potential areas (5%), low potential areas (2%), moderate potential areas (61%), and high potential areas (32%).
- Proposed occupied Gunnison sage-grouse critical habitat: approximately 67,000 acres, including high potential areas (83%) and moderate potential areas (17%).
- State wildlife areas: approximately 19,000 acres including moderate potential areas (54%) and high potential areas (46%).

Lands assigned an NSO stipulation in Alternative C total approximately 1,063,721 acres, or 70% of the lands available for leasing.

- NSO stipulations that apply to highly erosive soils and steep slopes (approximately 162,800 acres, or 31%) comprise the greatest amount of the NSO stipulated lands in Alternative C, of which 45% occur in no to low potential areas and 55% occur in moderate potential areas.
- NSO stipulations prescribed to protect recreation and scenery desired conditions, including national scenic byways, developed recreation and administrative sites, and MA 8 designations on SJNF lands comprise an additional 222,800 acres in Alternative C, of which approximately 47% occur in no to low potential areas, 37% occur in moderate potential areas, and 16% occur in high potential areas.
- The remaining 1,381,628 NSO stipulated areas include protections for resources such as riparian areas and related water bodies, critical wildlife habitat, scenic and recreational river corridors, important viewsheds, old growth habitat, the Old Spanish Trail, SBAs, threatened and endangered species habitat, and designated WSR scenic sections.

Table 2.4.24 presents leasing availability and associated stipulations for USFS- and BLM-administered lands that apply to Alternative C.

Table 2.4.24: Oil and Gas Leasing Availability by Mineral Estate Owner for Alternative C

Planning Area	USFS	BLM	Federal Subsurface	Total
Federal mineral acres	1,863,402	503,466	319,957	2,686,825
Acres withdrawn from leasing	509,954	0	0	509,954
Acres administratively not available for leasing	644,113	161,637	0	805,750
Acres available for leasing	709,335	341,829	319,957	1,371,121
NSO	547,642	318,601	197,478	1,063,721
CSU	391,150	300,504	171,786	863,440
TL	157	64	0	221
Standard lease terms	129,069	16,729	110,718	256,516

2.4.6.d Alternative D – Oil and Gas Leasing Availability

Of the combined SJNF and TRFO mineral estate, Alternative D makes 78% of the lands available for lease, the most of all the alternatives. Alternatives A and D have nearly the same amount of acres

available and not available for lease (Volume III, Appendix V, Maps 52, 56, 60). Differences in areas not available for lease between Alternatives A and D include the addition of national archeological districts in Alternative D on SJNF lands and fewer acres on TRFO lands due to the difference in WSR recommendations (Alternative A includes the Dolores River, whereas, Alternative D does not).

Areas administratively not available for leasing total approximately 71,800 acres and have the following oil and gas resource potential:

- WSAs (BLM): approximately 55,400 acres are primarily located within no potential areas (10%), moderate potential areas (35%), and high potential areas (55%).
- Chimney Rock, Anasazi, and Falls Creek Archaeological Areas (approximately 22,000 acres on NFS lands) are primarily located within low or no potential areas (5%), moderate potential areas (28%), and high potential areas (67%).

Lands stipulated as NSO total approximately 799,000 acres or 38% of the lands available for leasing, and have the following resource potential:

- Approximately 566,100 acres are applied to CRAs, of which 66% occur within no to low potential areas and 34% in moderate to high potential areas. Lands recommended for wilderness (and thus administratively not available for lease under Alternatives B and C) are stipulated NSO under Alternative D.
- Stipulations developed to protect highly erosive soils and steep slopes comprise an additional 16% (approximately 165,000 acres) of the total NSO lands in Alternative D, of which 44% occur in no to low potential areas and 34% occur in moderate potential areas.
- Recreation-related stipulations, including downhill ski areas, and developed recreation and administrative sites cover approximately 41,600 acres in Alternative D, of which 55% occur in no to low potential areas and 37% in moderate potential areas.
- The remaining stipulated NSO areas, 282,764 acres, include critical wildlife habitat, archeological areas, existing and proposed RNAs, the Dolores River Canyon unique landscape, state wildlife areas, and threatened and endangered species habitat.

Table 2.4.25 presents leasing availability and stipulations for Alternative D.

Table 2.4.25: Oil and Gas Leasing Availability by Mineral Estate Owner for Alternative D

Planning Area	USFS	BLM	Federal Subsurface	Total
Federal mineral acres	1,863,402	503,466	319,957	2,686,825
Acres withdrawn from leasing	509,954	0	0	509,954
Acres administratively not available for leasing	14,896	56,916	0	71,812
Acres available for leasing	1,338,551	446,550	319,957	2,105,058
NSO	666,105	98,486	34,565	799,156
CSU	1,033,242	406,487	214,665	1,654,394
TL	45,463	28,679	461	74,603
Standard lease terms	210,570	35,570	104,039	350,179

2.4.6.e No Leasing Alternative

The No Leasing Alternative is analyzed per direction in 36 CFR 228.102(c)(2)&(3) which requires the USFS, when considering oil and gas leasing, to analyze an alternative of not leasing. A No Leasing Alternative is also applied to BLM administered public lands to achieve a consistent set of alternatives among the two land management agencies (Table 2.4.26). Under the No Leasing Alternative, 2,176,871 (i.e., all lands that are not already withdrawn) would be administratively not available for leasing (Volume III, Appendix V, Map 61). Under the No Leasing Alternative existing leases would not be affected and would continue through their terms.

Table 2.4.26: Oil and Gas Leasing Availability on the San Juan National Forest and Tres Rios Field Office for the No Leasing Alternative

Planning Area	USFS	BLM	Federal Subsurface	Total
Federal mineral acres	1,863,402	503,466	319,957	2,686,825
Acres withdrawn from leasing	509,954	0	0	509,954
Acres administratively not available for leasing	1,353,448	503,466	319,957	2,176,871
Acres available for leasing	0	0	0	0

2.5 Summary and Comparison of Environmental Consequences

This section contains a comparison summary of the each of the alternatives as they relate to the issues identified and tracked through the analysis in the FEIS. This FEIS is a programmatic document. It discusses environmental effects on a broad scale and does not predict what would happen when such broad-based standards and guidelines are implemented on individual, site-specific projects. Nor does it convey the long-term environmental consequences of any site-specific project. The actual consequences (impacts) would depend on the extent of each project, the environmental conditions at the site (which can vary widely across the public lands), and the mitigation measures and their effectiveness.

2.5.1 Terrestrial Ecosystems and Plant Species

Several ecosystem types have been identified and considered in the analysis: spruce-fir forests, aspen forests, cool-moist mixed conifer forests, warm-dry mixed conifer forests, ponderosa pine forests, pinyon-juniper woodlands, mountain shrublands, mountain grasslands, sagebrush shrublands, semi-desert shrublands, and alpine terrestrial ecosystems. Management of various resources and resource conditions (recreation, range, minerals, etc.), as described in each alternative, could result in impacts to the various ecosystem types. Generally, Alternative D would result in more area available for management activities that could result in effects to the various ecosystem types. Alternative C, with a few minor exceptions, would result in the fewest acres available for management activities that could result in effects to the various ecosystem types.

2.5.2 Terrestrial Wildlife

Nearly all multiple-use activities conducted in the planning area under LRMP implementation, and described in this analysis, have some potential to impact terrestrial wildlife habitats, species, or individuals. Activities that have greater potential to affect wildlife habitat capability or species include

travel management, oil and gas development, road construction and road management, livestock grazing, fire and fuels management, hard rock mining, and timber management. Activities with lesser impacts include aquatic and riparian habitat improvement projects, watershed improvement projects, abandoned mines and hazardous materials projects, developed recreation facilities, prescribed burns, utility corridor ROWs, and ski area modifications and expansion.

Amphibians and Reptiles (potential impacts from projected outputs)

Under all alternatives, potential impacts would be limited by implementation of LRMP components. However, the potential for habitat and species impacts and the potential need for management and monitoring of amphibians and reptiles and their habitats would be greatest under Alternative D because it has the highest projected level of outputs that could adversely impact habitats for amphibians and reptiles. Alternative C has the least projected outputs that could impact amphibian and reptile habitat. Potential adverse impacts from outputs to amphibian and reptilian habitat would be similar under Alternatives A and B, which fall between the levels for Alternatives D and C. With effective implementation of LRMP standards and guidelines and applicable management direction from other referenced guidance, adverse impacts to amphibian and reptile habitat from LRMP implementation activities are expected to be generally minor and localized and are not expected to result in measureable changes to species abundance or distribution across the planning area.

Migratory Birds

In general, the amount of habitat likely to be altered by projects conducted under LRMP implementation under any of the alternatives is expected to be relatively small, when compared to the total amount of habitat currently available within the planning area. For this reason, and for most species, the impacts of direct habitat alteration on migratory birds would be generally small and not sufficient to result in population-level impacts or in changes to species distribution across the planning area. Impacts to migratory bird habitats are expected to be similar across all LRMP alternatives for those program areas that have similar projected program outputs, such as fire and fuels treatments. In general, the impacts of LRMP implementation are likely to be greatest under Alternative D and the least under Alternative C. Alternatives A and B are projected to have relatively similar potential for impacts to migratory birds.

Mammals

The vast differences in life history and habitat requirements among the mammal species that inhabit the SJNF and TRFO suggest that mammal species may be influenced by management actions and/or by human activities in widely differing ways and to different extents. A variety of impacts that could vary greatly in intensity are expected during LRMP implementation, resulting in widely varying potential impacts on the mammal group as a whole. The potential for impact, as well as the need for adjustment and monitoring of project effects to some mammal species and their habitat components, is likely to be greatest under Alternative D. Impacts to mammals is likely to be least under Alternative C and is likely to be similar between Alternatives A and B. The differences would be due to the slight acreage increase in potential outputs under Alternative D in relation to the number of acres available for timber harvesting, the available livestock AUMs, fluid minerals development scenarios, and the substantial increase in acres suitable for summer motorized travel.

Threatened and Endangered, Candidate, and Proposed Species

For listed species, actions associated with implementing the selected alternative may impact a listed species and/or its habitat. LRMP components including mitigation, stipulation, and conservation

measures are expected to conserve listed species regardless of the selected alternative. Separate site- and project-specific consultation with the USFWS would be undertaken during the NEPA process, as necessary, when projects are proposed for implementation under the LRMP.

Sensitive Species

In general, within the planning area the wide variety of sensitive species and wide variety of their preferred habitats suggests that all LRMP alternatives have potential for some affect to some sensitive species or their preferred habitats. Effects could be both adverse and beneficial, depending on the species and habitats affected. Application of LRMP standards and guidelines and management recommendations from referenced documents and manuals during project design and implementation should ensure that the scale of impact is minimized and the intensity of effects is reduced to the extent possible. The potential for impact, as well as the potential need for adjustment and monitoring of project effects to some sensitive species and their key habitat components is likely to be greatest under Alternative D. The potential for impacts to sensitive species is likely to be least under Alternative C and is likely to be similar between Alternatives A and B. Alternative D would also have a larger amount of land area available for active management activities that may, in turn, impact habitats for sensitive species, movements of individuals, and the potential for human disturbance to sensitive species or their key habitats or use areas. Alternatives B, C, and D would eliminate cross-country motorized use. Eliminating cross-country motorized travel and limiting motorized travel to a system of designated routes would substantially reduce the potential for disturbance to sensitive species, compared to the potential for disturbance in areas of unrestricted cross-country travel that would remain available under Alternative A.

2.5.3 Riparian Areas and Wetland Ecosystems

Adverse impacts to riparian areas and wetland ecosystems from management activities would be minimized or prevented by the implementation of standards, guidelines, and stipulations in the LRMP, the implementation of project mitigation measures, and by following direction from agencies' guidance, manuals, and handbooks, as well as applicable laws and regulations. The types of management activities that would most likely affect riparian and wetlands include vegetation manipulation including fire, fuels, and timber management, solid and fluid mineral development, livestock grazing, and recreation. Generally Alternative C would result in fewer acres allocated for those management activities that could adversely impact riparian areas and wetland ecosystems. Alternative D would result in the highest potential allocation of acres for activities that could result in adverse effects to riparian areas and wetland ecosystems. Alternatives B and A are similar in acres allocated and fall between Alternatives C and D.

2.5.4 Aquatic Ecosystems and Fisheries

Based on the assessment of current aquatic conditions, it appears that the greatest risks to fish and aquatic species are from management activities that directly impact streams, riparian areas and wetlands ecosystems, and/or aquatic community composition. Activities with greater impacts include water use and development projects, road construction and road management, oil and gas development, hard rock mining, mining reclamation, and grazing. Activities with lesser impacts include timber harvesting, mechanical fuels reduction projects, rangeland treatments, wildfire, prescribed burns, utility corridor projects, ski area modifications and expansion, and OHV use. Overall, the long-term impacts related management activities on fisheries and aquatic habitat would be minor. By alternative, the greatest impacts could result from Alternatives D and A. Alternative B would result in less than Alternatives D and A with the greatest potential for adverse impacts from

Alternative C. These impacts vary by alternative due to the variations in amounts of acres allocated for various management activities proposed under each alternative and to the corresponding impacts on fish habitat from sediment and increased stream temperatures.

2.5.5 Water Resources

Each of the alternatives would allow for annual watershed restoration projects (including erosion control, stream restoration, riparian/lake/fen treatments, road decommissioning, and/or fish habitat improvement). Alternatives B and C would propose similar goals, with Alternative C treating more acres and stream miles than all other alternatives. The potential effects to watersheds would be similar to those of riparian areas and wetland ecosystems and aquatic ecosystems and fisheries. Alternatives A and D would treat substantially fewer acres and stream miles than Alternatives B and C, meaning that Alternatives B and C would produce the highest levels of beneficial watersheds impacts.

2.5.6 Livestock and Range Management

Under Alternatives A and B, changes to livestock grazing management would generally be minor in that permitted AUMs would only change by approximately 2% from Alternative A to B. Alternative A would propose to continue current permitted livestock levels. Alternative B would propose to slightly increase permitted AUMs through consolidating/combining some of the allotments. Alternative C would be the most restrictive alternative in that livestock grazing would be managed in order to enhance wildlife, cultural, and soils values, which would result in lower stocking rates. Alternative D would propose to increase livestock grazing by offering vacant USFS allotments to qualified operators, increasing stocking rates via restoration activities on BLM allotments in the improve and maintain categories where rotational grazing systems are in place, maintaining stocking levels on BLM allotments elsewhere, and increasing AUMs on USFS grazing allotments within those areas where restoration activities are planned.

2.5.7 Invasive Species

The alternatives that allow for the most ground-disturbing activities would provide the most opportunities for invasive species to establish and spread. Actions under Alternative A would have the greatest potential to introduce and spread invasive species. Alternative A would be followed by Alternatives D, B, and C. Mineral development ground-disturbing activities would continue even if no additional oil and gas leasing occur. Best management practices (BMPs), mitigation measures, and public education and awareness programs would continue to be used in order to limit the introduction and spread of invasive species. Based on observations on the SJNF and TRFO, impacts would continue to be long-term and moderate. Using early detection and rapid response strategies, most invasive species should be contained, based on successful use of these practices on the SJNF and TRFO.

2.5.8 Timber and Other Forest Products

The alternatives vary in areas where timber management may occur in order to achieve the desired vegetative conditions and objectives for timber program offerings. Alternative A would have the most acres available for management and highest harvesting objective in terms of number of acres, with Alternatives D, B, and C following in descending order, respectively. Alternative D would result in the greatest opportunity to provide vegetative conditions that limit the intensity and extent of disturbances

(including from wildfire and insect epidemic), whereas Alternative C would provide the least opportunity.

2.5.9 Insects and Disease

The projected area available to allow thinning/harvesting over the 15-year period of the LRMP ranges from 2.5% (Alternative C) to 4.4% (Alternative D). The potential area that could be burned (and concurrently meet insect/disease management objectives) is much greater, but managed fire is not expected to impact a significant area of the forest due to constraints tied to prescribed fire. Hence, effects from insects or disease would tie more closely with forest conditions and affecting factors—that is, 1) amount, extent, and susceptibility of host habitat, 2) insect or disease levels (extent and populations/infection rates), 3) climate, and 4) disturbance (such as windthrow events that create spruce-beetle preferred host material)—than from actual management activities. The impacts from chemical treatments or pheromone applications for insect/disease are expected to be similar across all alternatives. The majority of these activities would fall in or near developed facilities.

2.5.10 Fire and Fuels Management

Estimates were made of the number of acres of fuels treatment attainable annually under each alternative. These estimates were based on values at risk, historic funding levels experienced by the public lands over the last few years, and management objectives for each alternative. The highest priority for mechanical treatments would continue to be adjacent to high-value areas, communities at risk, and areas identified in community wildfire protection plans. From a cost perspective related to fire suppression, Alternative B would result in the lowest projected costs, followed by Alternatives A, D, and C, respectively. From a resource perspective, the alternatives with the greatest opportunity for vegetation management activities would potentially result if the greatest reduction in effects from fire due to reduced vegetation. Conversely opportunity for activities such as mineral development and motorized recreation could potentially increase the risk of human caused ignitions and possibly increase the risk to human health and safety.

2.5.11 Air Quality

The air quality modeling is presented in consideration of the oil and gas leasing availability decision. The air quality thresholds of significance developed by the USFS and National Park Service (NPS) were used in determining potential impacts to Class I areas and sensitive Class II areas. This is because the USFS and NPS manage all of the Class I and most of the sensitive Class II areas within the modeling domain. The one exception, Canyons of the Ancients National Monument, is managed by the BLM. It should be noted the BLM uses different thresholds of significance than the USFS and NPS. If no additional federal lands are offered for lease, some wells in the Paradox Basin (GSGP and conventional Paradox wells) would still be drilled. This is because some NFS and BLM lands are already leased and there are state and private lands that can be developed.

2.5.12 Access and Travel Management

The acreage identified as suitable for motorized travel on NFS lands and limited for BLM land would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and would be the least under Alternative C.

Under Alternative A, the current over-ground and oversnow travel management direction for both NFS and BLM lands would remain unchanged from current direction. Alternatives B, C, and D would result in establishment of travel suitability classifications on NFS lands and would result in OHV area

designations on BLM lands. For Alternatives B, C, and D, the areas classified as unsuitable (NFS) or closed (BLM) to motorized travel would increase by approximately 49% under Alternative D, increase by 83% under Alternative B, and increase by 119% under Alternative C. The primary reason for this major change is that each of the action alternatives would result in eliminating areas open to cross-country motorized travel, as is allowed under the current travel management on BLM lands. Alternative A would result in the highest level of road construction, followed by Alternatives D, B, and C.

2.5.13 Recreation

In general, recreation opportunities available within each ROS setting would change to some degree between alternatives, and a large portion of the planning area would still be allocated to each ROS setting. Certain activities may be limited in geographic extent but would still be allowable, and other activities may have larger areas managed for that use.

Recreation facilities would not be noticeably impacted in relation to any of the alternatives due, in part, to the long-term established use of these facilities, as well as to their current capacity, the ability to handle increased occupation, and the considerable public investment in facility operation. Implementation of any of the alternatives would not impact the number and location of facilities.

All alternatives would continue the current permitted ski areas (Durango Mountain Resort and Silverton Mountain). Alternative D includes allocation of an area for expansion of the existing Wolf Creek ski area onto the SJNF. Wolf Creek ski area has been permitted long term on the Rio Grande National Forest east of the Continental Divide, but if future development is approved within the allocated area, this would increase developed ski area acreage on the SJNF. Alternative A would carry forward ski areas from the 1983 LRMP. Alternative D would also keep the potential ski area in the East Fork of the SJNF that was in the 1983 LRMP. The East Fork ski area would impact the roadless character of the South San Juan Adjacent Inventoried Roadless Area (IRA) and would increase commercial skiable terrain in the planning area.

Alternative B would do the most to minimize conflicts between winter sports users by directly avoiding contact between users and by maintaining settings consistent with achieving either motorized or non-motorized recreation benefits, rather than by default mixing the two.

2.5.14 Scenery and Visual Resource Management

On NFS lands, scenic integrity levels are used to assess current scenic conditions and the potential impacts under the alternatives. Scenic integrity levels are used to measure the human-caused disturbance that deviates from the dominant valued attributes of the landscape character. SIOs are then developed based, in part, on the scenic integrity levels but may also be determined by other resource allocations and uses as analyzed in the land use planning process. The scenic integrity levels are used to compare the impacts between the alternatives.

On lands administered by BLM, Visual Resource Inventory (VRI) classes are assigned to land units based on scenic quality, sensitivity level, and distance zones. The VRI for the public lands serves, in part, as the basis for the VRM class determinations, although other resource allocation decisions are also considered when designating VRM classes. A VRM class is based on the degree of acceptable visual change within that landscape, which may factor the physical and sociological characteristics of any given homogeneous area and serves as a management objective. Each class has an objective, which prescribes the amount of change allowed in the characteristic landscape.

Table 2.5.1 displays a comparison of the amount of natural-appearing landscape expected under each alternative. Alternative C would provide for more acres of natural appearing landscape than would Alternatives A and D. This would be primarily due to the amount of oil and gas, timber harvesting, and fuels reduction activities that could take place under each alternative, as well as to the associated mitigation measures required for oil and gas development (stipulations).

Table 2.5.1: Natural-appearing Landscape Expected under Each Alternative

	Current Condition	Alt. A	Alt. B	Alt. C	Alt. D
Percentage natural-appearing landscape	96%	79%	90%	99%	81%

2.5.15 Heritage and Cultural Resources

Under all of the alternatives, the heritage/cultural resource program would provide support to all resource projects, as required by Section 106 of the NHPA. Prior to any federal undertaking within the planning area, the SJNF and/or TRFO must consider impacts to heritage and cultural resources. Under all of the alternatives, the preferred management strategy for eligible sites would be to avoid and protect these sites from direct, indirect, and cumulative effects. In addition, under all of the alternatives, the program would include proactive inventory, documentation, analysis, preservation, monitoring, stabilization, research, stewardship, and public interpretation and education. It is difficult to measure individual adverse impact components; therefore, the number of acres of ground disturbance may be used as a relative comparison of alternatives. Given the enormity of the planning area (more than 2.5 million acres) and the diversity of its landscapes (which results in a wide variability of heritage/cultural site densities, ranging from three sites per square mile to more than 100 sites per square mile), it would be very difficult to make reasonably accurate quantitative assessments of impacts without activity locality information. Therefore, a descriptive, qualitative analysis of the impacts is presented.

Under all of the alternatives, impacts to heritage and cultural resources from oil and gas development would be alleviated through identification, avoidance, and/or mitigation. However, a minor amount of direct and indirect impacts may still result during surface-disturbing activities due to unanticipated discoveries of heritage and cultural resources, off-site erosion, and increased access to heritage and cultural resources. Therefore, Alternative A, which would management activities on the largest amount of acres, could result in the largest amount of impacts to heritage and cultural resources. This would be followed by Alternative D, which has the second highest amount of acres. Alternative B would have less potential impacts to heritage and cultural resources than Alternatives A or D. Alternative C would have less potential impacts to heritage and cultural resources than Alternative B.

Potential specific adverse impacts to heritage and cultural resources related to oil and gas development would be properly addressed under project-specific oil and gas environmental assessments; however, the No Lease Alternative would have the least potential impacts to heritage and cultural resources than all of the other alternatives.

2.5.16 Paleontological Resources

Impacts to paleontological resources within the planning area may result from actions proposed under the following resource management programs that have the potential to disturb fossil-bearing geologic formations: minerals development; prescribed fire, fire suppression efforts, and fuels management; recreation; lands and reality actions; and travel management. Management measures

common to all alternatives would preserve and protect paleontological resources for present and future generations. Adverse impacts would be mitigated by avoidance, recordation, or collection by a qualified paleontologist.

Under all of the alternatives, the risks of damage or destruction of paleontological resources could result from mining of vanadium/uranium, unauthorized activities (including dispersed recreational activity, OHV use, vandalism, and unauthorized collection), and natural processes of weathering. Impacts to paleontological resources from these activities would be the same under all alternatives. Paleontological surveys and excavations performed as a result of uranium/vanadium mining plans of operation could be major contributors to the knowledge and understanding of paleontological resources. This beneficial impact to paleontological management could result under all of the Alternatives. Paleontological locality would be protected through an NSO stipulation in Alternatives A, B, and C, and a CSU stipulation under Alternative D.

2.5.17 Lands and Special Uses

Under all alternatives, the TRFO and SJNF could acquire land dependent on having a willing seller. The USFS has limited opportunity for direct disposal of NFS lands; therefore, most land adjustments involving NFS lands would be by land exchange. This is not expected to vary by alternative. The BLM would continue its land adjustment program with land exchanges, as well as with the sale or exchange of lands specifically identified for disposal. The potential for disposing of BLM lands is highest in Alternatives B and D with 15,327 acres of lands available for disposal, followed by Alternatives A (10,469 acres) and C (8,004 acres). Additional criteria for identifying other lands for disposal are found in the LRMP and would not vary by alternative. Under all alternatives, through cooperation with other landowners, the emphasis would be for improved landownership and access patterns that benefit private landowners and the public.

Allocation of avoidance and exclusion areas under the various alternatives would impact the accessibility of lands for the location of pipelines, transmission lines, communication sites, and other ROWs or special use authorizations. Under Alternative D, 1,210,597 acres would be within avoidance areas, where land use authorizations such as utility corridors and communications sites can occur but with restrictions, followed by Alternatives A, B, and C. Avoidance areas in each alternative encompass lands managed for wilderness charateristics, Dolores River Canyon, Mesa Verde Escarpment, Anasazi Culture ACEC, Perins Peak wildlife management area, upper tier CRAs, Falls Creek Archeological Area, SBAs, Chimney Rock National Monument, and VRM II/high SIO areas. Alternative C is the most restrictive in terms of impacts to lands and realty actions with 1,138,759 acres within exclusion areas, followed by Alternatives B, A, and D. Exclusion areas in each alternative encompass WSAs, wild segments of suitable WSRs, MA 1, RNAs, wilderness areas, the Piedra Area, and areas recommended for wilderness designation.

2.5.18 Minerals and Energy: Fluid Minerals

Alternative A represents the continuation of current BLM and USFS leasing direction as it applies to the PLAA. In total, 2,868,667 acres are available for leasing in Alternative A, of which approximately 518,300 acres are stipulated with TL, 185,300 acres are stipulated with CSU, and 908,400 acres are stipulated with NSO. Projected oil and gas development for the BLM and NFS lands under Alternative A includes approximately 590 well pads. Approximately 90 well locations are projected to be non-productive and reclaimed after production testing. For the GSGP alone, 420 well pads would be constructed on future leases. See Table 2.5.2.

Alternative B is the preferred leasing alternative. Approximately 2,060,700 acres are available for lease within the PLAA, of which approximately 617,800 acres are stipulated with TL, approximately 920,500 acres are stipulated with CSU, and approximately 1,132,700 acres stipulated with NSO. Areas that are administratively not available for leasing total approximately 154,400 acres. Projected oil and gas development for the BLM and USFS combined under Alternative B includes approximately 575 well pads on future leases. Approximately 90 well locations are projected to be non-productive and reclaimed after production testing. Projected GSGP well pads would total 410 on future leases.

Under leasing Alternative C, production of goods and services are less than proposed under leasing Alternatives A, B, and D.

Approximately 1,332,500 acres would be available for lease in Alternative C. Designated wilderness areas and the Piedra Area are withdrawn from leasing by law. Approximately 532,300 acres recommended for wilderness or WSR designation (wild river segments) are administratively not available for mineral leasing under Alternative C, the highest among the alternatives. Seventy percent of the areas proposed for withdrawal occur in no or low potential areas. CRAs not recommended for wilderness in Alternative C are stipulated with NSO. On lands outside CRAs, a full range of stipulations are assigned including stipulations such as TL, CSU, and NSO to protect various resources such as highly erosive soils, steep slopes, critical wildlife habitat, and areas with special management designations such as archaeological areas, among others. Areas that are administratively not available for lease total approximately 873,100 acres.

Projected oil and gas development for the BLM and USFS combined under Alternative C includes approximately 570 well pads on future leases. Approximately 90 well locations are projected to be non-productive and reclaimed after production testing. Projected GSGP formation well pads would total 405 on future leases.

Alternative D provides for a mix of multiple-use activities, with a primary emphasis on the “working forest and rangelands” concept in order to produce a higher level of commodity goods and services compared to the other alternatives. This alternative provides for the greatest extent of resource use within the planning area while, at the same time, protecting and sustaining resources.

Approximately 2,058,700 acres are available for lease in Alternative D, of which approximately 342,970 acres are stipulated with TL, 292,795 acres are stipulated with CSU, approximately 1,055,550 acres are stipulated with NSO, and 288,235 acres are stipulated with standard lease terms. Alternative D does not include any wilderness or WSR recommendations and thus no proposal that lands be withdrawn from leasing. IRAs are stipulated NSO in Alternative D. On lands outside IRAs, a full range of stipulations are assigned including TL, CSU, and NSO to protect various resources such as highly erosive soils, steep slopes, critical wildlife habitat, and areas with special management designations such as archaeological areas, among others

Projected oil and gas development of future leases for the BLM and USFS combined under Alternative D includes 585 well pads. Of this total, approximately 85 wells are projected to be non-productive and would be reclaimed after production testing. Within the GSGP proper, 415 well pads would be constructed on future leases.

Table 2.5.2: Oil and Gas Leasing Availability by Alternative within the Planning Area

Jurisdiction	Alternative A	Alternative B	Alternative C	Alternative D	No Lease Alternative
SJNF					
Federal mineral acres	1,863,394	1,863,394	1,863,394	1,863,394	1,863,394
Acres withdrawn from leasing	481,035	481,035	481,035	481,035	481,835
Acres administratively not available for leasing	23,973	81,848	659,733	21,934	0
Acres available for leasing	1,358,386	1,300,511	722,626	1,360,425	0
NSO	808,252	831,170	499,935	680,024	0
TL	140,356	34,315	0	288,795	0
CSU	149,846	291,151	91,003	0	0
Standard lease terms	260,742	144,714	132,539	393,336	0
TRFO					
Federal mineral acres	503,464	503,464	503,464	503,464	503,464
Acres withdrawn from leasing	0	0	0	0	0
Acres administratively not available for leasing	67,197	68,717	203,979	55,925	503,464
Acres available for leasing	436,267	434,747	299,485	447,539	0
NSO	108,361	243,456	589,353	112,252	0
TL	551,221	525,469	64	28,899	0
CSU	38,076	528,332	259,541	237,654	0
Standard lease terms	87,754	32,220	29,767	221,689	0
Federal Subsurface					
Federal mineral acres	319,809	319,809	319,809	319,809	319,809
Acres withdrawn from leasing	0	0	0	0	0
Acres administratively not available for leasing	1,462	1,462	45,868	1,462	319,809
Acres available for leasing	318,347	318,347	273,941	318,347	0
NSO	11,765	58,060	165,647	37,666	0
TL	132,486	58,060	–	417	0
CSU	14,933	101,025	28,644	53,302	0
Standard lease terms	157,336	99,375	77,823	225,135	0

2.5.19 *Minerals and Energy: Solid Minerals*

Under all of the alternatives, development of salable mineral materials would be impacted based on the number of acres restricted or recommended for closure to mineral activity since development of these solid minerals resources is discretionary. Locatable minerals subject to claim under the Mining Law of 1872 would not be similarly impacted under all of the alternatives. Unlike mineral materials, which occur throughout the planning area, significant deposits of locatable solid minerals are unlikely to occur outside these areas; therefore, impacts to this resource under any of the alternatives may be minor. Impacts to DOE uranium lease tracts would not vary by alternative since these lease tracts are administered by the DOE and are not subject to any of the alternatives. Locatable uranium/vanadium development may be impacted by restrictions related to protection of sage-grouse since the most important uranium/vanadium deposits are in the same geographic area.

Based on the total acres of the various management actions designations that could limit the development of solid minerals, Alternative C may result in moderate to minor impacts, followed by Alternatives B, D, and A, all with minor to negligible impacts.

2.5.20 Minerals and Energy: Alternative Energy

With no to very low potential for commercial geothermal development, wind, or solar power generation on public lands in the planning area, the environmental consequences described in this section only analyze biomass as a potential energy source. Facility construction and operation for biomass energy generation sites would be the same as for the construction and use of other facilities, and would require a specific area to be dedicated to a primary use and, secondarily, to other compatible uses.

Potential biomass generation facilities would be located near communities and existing infrastructure. They would rely on existing transportation facilities for moving materials to a centralized generation plant. Standards and guidelines would be the same under all of the alternatives, and restrictions on development would be implemented in order to ensure compliance with laws and regulations governing development projects. Given the minimal expected level of alternative energy development expected during the life of the LRMP, there may be no reasonably measurable differences between the alternatives.

2.5.21 Wilderness and Lands with Wilderness Characteristics

Under Alternative B, for NFS lands, approximately 55,533 roadless acres would be recommended for wilderness. Under Alternative C, approximately 526,344 roadless acres would be recommended for wilderness. Alternatives A and D would not propose any NFS lands for wilderness. The areas recommended for wilderness are typically somewhat smaller than the inventory areas. However, under Alternative C, all of the roadless areas (except for the HD Mountains due to existing oil and gas leases) would be recommended for designation as a wilderness area, a WSR, or an RNA.

For lands administered by BLM, the alternatives present a range of options with regards to lands with wilderness charateristics. When compared to Alternatives A and D, Alternatives B and C both offer greater protection for the wilderness characteristics on the TRFO. Alternative C protects all seven units where wilderness characteristics were found, with Alternative B protecting two units. Thus, Alternative C offers the greatest degree of protection for wilderness characteristics, and Alternative B to a lesser degree. Both Alternatives A and D offer no specific protection for wilderness characteristics in the seven units.

2.5.22 Wild and Scenic Rivers

Only the previously studied and recommended rivers are found suitable in Alternative A. Alternative C finds all river segments identified as eligible through the inventory process for this planning effort and FEIS to also be suitable. Alternative D shows none of the rivers to be found suitable. Alternative B, the Preferred Alternative, finds about two-thirds of river miles to be suitable. Potential impacts related to all other activities on WSR would be proportional to the number of miles of river found preliminarily suitable, as the suitable river corridors have higher standards for protection and less tolerance for development activities. Conversely, if designated as WSRs by Congress or the Secretary of the Interior, beneficial impacts to river resources would result due to the higher level of protection afforded them under the WSRA. Alternative C would result in the most potential protection to rivers under the WSRA, followed by Alternatives B and A, respectively. This comparison is based directly on miles of river found to be suitable. Alternative D would result in no additional river corridor protection, although standard BMPs regarding riparian corridors and water resource protection would still apply to any projects within those zones.

2.5.23 Scenic, Historic, and Backcountry Byways

Generally, all of the alternatives are similar with respect to desired future conditions, thematic direction, and design guidelines for land management of the routes (and adjacent lands) within the viewsheds. Differences exist between the alternatives regarding oil and gas stipulations. In reference to oil and gas leasing stipulations, Alternatives A and D (under CSU) would provide less scenic protection to these roads and trails than would Alternatives B or C (which prescribe NSO), although all of the alternatives propose more protective oil and gas stipulations. If no new oil and gas leases were made available, the impacts to scenic byways would be similar under all alternatives because most of the development would occur on existing leases only. The ability to move facilities to eliminate visual impacts may be limited by CSU, allowing surface occupancy within closer proximity of or within the 0.5-mile corridors; therefore, visual impacts would have a higher probability of occurring under CSU than under an NSO requirement.

2.5.24 National Recreation, Scenic, and Historic Trails

Alternative A would not propose the same viewshed protection for the trails as Alternatives B, C, and D. Alternatives B, C, and D all establish these trails as important viewer locations, and they incorporate standards, guidelines, and stipulations designed to protect the foreground viewshed along these routes. Alternative B would impose varying degrees of viewshed protection, primarily dependent on the MA designation of the lands within which the routes travel. Via the MA allocations, Alternative B contains somewhat more restrictive management criteria than Alternative D, but to a lesser degree than Alternative C. Alternative C would allow the lowest potential for developments or other active management activities that would be visible from or otherwise affect the trails. On the contrary, Alternative D has the greatest potential for allowing developments that would be visible or otherwise affect the trail corridors. Other issues, including trail access, shared use, way finding, and maintenance, would not differ between the alternatives. If no new oil and gas leases were made available, the impacts to national recreation and scenic trails would be similar to the impacts under all alternatives because most of the development would occur on existing leases.

Regardless of the alternatives, the 1968 National Trails System Act prevents land management agencies from taking actions that would directly and/or significantly alter the immediate surroundings of the trail corridors or that would degrade the specific resources for which the trail was designated.

2.5.25 Research Natural Areas

The SJNF currently contains two RNAs, Narraguinnep and Williams Creek. Twenty-one additional areas were considered for RNA designation through the LRMP revision process, primarily selected from unroaded areas, vacant or closed grazing allotments, and lands with few management conflicts.

Alternative C proposes the most RNAs so it would provide the most lands for research, education, and reference sites; the most protection for biodiversity on the SJNF; and the most amount of protected areas on NFS lands. Alternative B proposes the second most RNAs, so it would provide the second most lands for research, education, and reference sites; the second most protection for biodiversity; and the second most amount of protected areas on the SJNF, followed by Alternative D. Alternative A proposes the fewest RNAs so it would provide the fewest lands for research, education, and reference sites; the least protection for biodiversity; and the least amount of protected areas on the SJNF.

2.5.26 Areas of Critical Environmental Concern

ACECs are BLM lands where special management attention is required to prevent irreparable damage to important historic, cultural, or scenic values, as well as fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards (BLM Manual 1613). FLPMA mandates the BLM to give priority to the nomination and designation of ACECs through the development and revision of RMPs.

Alternative C would designate the most ACECs so it would provide the most protection for the relevance and importance values and biodiversity in the planning area. Alternative B proposes the second most ACECs so it would provide the second most protection for the relevance and importance values and for biodiversity, followed by Alternative A. Alternative D would designate the fewest ACECs, so it would provide the least protection for the relevance and importance values and biodiversity within the TRFO.

2.5.27 Economics

To estimate the economic impacts to the planning area economy, one model covering five counties was developed. The counties included Archuleta, Dolores, La Plata, Montezuma, and San Juan. This area matches both state and local recognition of a functional social and economic planning area.

As discussed in Section 3.14, Recreation, the total number of visitors to the planning area is projected to hold steady over the planning horizon for all of the alternatives. Current recreation patterns are also expected to hold steady across alternatives. Therefore, the economic effects of recreation are not expected to vary.

Compared with the current management alternative (Alternative A), livestock grazing production would be generally maintained under Alternative B, would drop by approximately 13% under Alternative C, and would increase by approximately 37% under Alternative D. Some permittees may maintain, or potentially even increase, the number of AUMs, with more intensive management.

Under Alternatives A and B, total harvest volume would increase by 40% compared with the 2009–2011 average. Harvest volume would increase by 19% under Alternative C, and by 76% under Alternative D. In all cases, the mix of products (e.g., sawtimber, fuelwood, and biomass) would remain unchanged from the 3-year average.

Variations driven by resource management concerns are not expected to result in substantial economic differences between the alternatives. Alternatives A and D would result in the largest number of wells and the highest production levels. By 2020 minerals-based employment in the five-county Colorado area would increase by about 470 jobs for Alternatives A and D, and by 450 jobs for Alternatives B and C. It should be noted that while job estimates are reported down to a single job, the reader should look for changes in relative magnitude between alternatives. Thus, the range of 20 jobs between the highest and lowest impact alternatives should not be regarded as substantial. The No Leasing Alternative would result in about 400 additional jobs over 2010 employment levels, or 70 jobs less than either Alternatives A or D in 2020.

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

Chapter 3 combines two chapters often published separately in EISs: the affected environment and environmental consequences (described below). These two discussions have been combined in order to provide a clearer understanding of how each resource might be affected (impacted), depending on the alternative selected. This chapter's purpose is to convey how each of the alternatives described in Chapter 2 is predicted to affect the natural and human environment.

- **Affected Environment:** The current physical, biological, human, and land use environments of the planning area are discussed. This description provides a baseline against which to compare the impacts that might result from implementing any of the four alternatives.
- **Environmental Consequences:** A description and comparison of the predicted environmental consequences of each of the four alternatives are discussed. The environment is considered to include the natural environment (resources), which includes ecosystem components (such as soils, forested vegetation, wildlife, etc.) and human uses and values (such as domestic livestock grazing, timber, recreation, heritage resources, scenic byways, etc.)

If a particular allowable use or management action is not discussed for a particular resource, it is because no impacts are expected or the anticipated impact is considered of minor consequence.

The following types of impacts are included in the evaluation of environmental consequences:

- **Direct/Indirect Impacts:** These impacts result from activities that generally occur at the same time and place as the management activity or through an action causing the impact or that may occur at some distance or time from the action. For example, indirect impact could occur days after the surface is disturbed, as well as some distance from the disturbance.
- **Short- or Long-term Impacts:** When applicable, the short- or long-term aspects of impacts are described. For purposes of this FEIS, short-term impacts occur during or after the activity or action and may continue for up to 2 years. Long-term impacts occur beyond the first 2 years.
- **Cumulative Impacts:** Cumulative impacts result from the interaction of impacts resulting from the implementation of an alternative, along with impacts resulting independently from unrelated actions and activities. Cumulative impacts may include public lands in the planning area, as well as both private and public lands adjacent to, or near, the planning area.

Past, present, and reasonably foreseeable future actions and trends considered in the cumulative effect analysis are described in the affected environment discussions for each resource section and/or within the cumulative effects narratives.

The environmental impacts associated with the implementation of any of the alternatives would be in addition to ongoing existing impacts occurring on USFS- and BLM-administered lands in the planning area, as well as both public and private lands adjacent to, or near, the planning area. The descriptions of cumulative impacts for the individual resources addressed in this chapter may be qualitative as well as quantitative.

LRMP components (standards and guidelines, allowable uses, etc.) listed under each section of the LRMP (Volume II) describe the environmental protection measures that would be applied to all of the alternatives at the project level in order to protect or improve resources. These plan components are referred to frequently throughout the FEIS where they are expected to offset impacts through mitigation.

Due to the programmatic and strategic nature of this FEIS, the timing and specific location of project-specific actions that could impact resource values are not defined. Moreover, the relationship between cause (future actions) and effect (impact on resources) is not always known or quantifiable. For these reasons, the analysis of alternatives is both qualitative and quantitative.

Federal laws require that the USFS and BLM ensure the long-term productivity of public lands. Both land management agencies have established regulations and policies to implement these laws. Additionally, the LRMP has established standards and guidelines that aim to protect the environment in the planning area from extreme or undesirable consequences. These standards and guidelines apply to all management activities and desired future conditions regardless of the alternative selected for implementation. Under each resource section that follows, the key legal and administrative guidance, such as laws, regulations, policies, best management practices, and area-wide guidelines that apply to management of SJNF lands are listed and are the direction and mitigations that apply to the evaluation of environmental consequences. Project-level analysis may indicate the need for additional mitigation in order to resolve site-specific issues. Monitoring efforts would help the managing agencies determine the effectiveness of mitigation measures (see the Monitoring section of Volume II, LRMP).

Relationship between Programmatic and Site-specific Analysis – This FEIS is a programmatic document. It discusses environmental effects on a broad scale and does not predict what would happen when such broad-based standards and guidelines are implemented on individual, site-specific projects, nor does it convey the long-term environmental consequences of any site-specific project. The actual effects (impacts) would depend on the extent of each project, the environmental conditions at the site (which can vary widely across the public lands), and the mitigation measures and their effectiveness.

The analysis presented in this FEIS would be used to "tier" to future analyses. NEPA defines tiering as the coverage of general matters in broader EISs with subsequent narrower statements or environmental analyses that incorporate by reference the general discussions, allowing discussions to then concentrate solely on the issues specific to the statement subsequently prepared. Tiering is appropriate when it helps the lead agency to focus on new issues and exclude from consideration issues already decided. Thus, the broader analysis and conclusions analyzed in this document can then be used as a starting point for future site-specific project planning in the planning area. Each future project's environmental effects analysis document would incorporate, by reference, the information found in the FEIS, without the need to repeat the broader analysis process.

The Oil and Gas Leasing Analysis

The leasing decisions associated with this LRMP and FEIS include what lands are available for lease, and for those lands made available, what stipulations will be applied to mitigate potential impacts from development. The leasing decisions primarily focus on future leases. However, the analysis does consider the potential impacts of new development on already leased lands, as well as cumulative impacts from development of adjacent non-federal mineral development (i.e., private, state, other).

Within the planning area there are three basins with moderate to high potential for mineral occurrence: the Paradox Basin (referred to as the PLAA for this analysis), the Northern San Juan Basin (NSJB), and the San Juan Sag. This analysis focuses on the PLAA because it is the area with the highest leasing interest within the planning area, as well as having high development potential as reflected in the RFD projections for the area, and because much of the area is currently unleased and subject to lease after approval of the LRMP. On the basis of these factors, the impacts from oil and gas focus on the PLAA.

The NSJB, primarily on SJNF lands, also has high potential for development. However, unlike the Paradox Basin, the NSJB is fully leased and developed. Within the NSJB, the remaining question is how to condition further development of existing leases as additional wells are proposed. Anticipated development would involve constructing infill wells on existing, expanded well pads. The analysis of NSJB development and the relation to the revised LRMP decisions is also analyzed in this chapter.

A third area with potential is the San Juan Sag. Given the limited past limited development history in the San Juan Sag, only one to two exploratory wells, annually, over the life of the LRMP are projected for the San Juan Sag. Because of the assumed minimal leasing interest in the San Juan Sag, and minimal development projections, the FEIS does not include a detailed analysis San Juan Sag.

The three principal components of the leasing analysis include:

1. Identification of areas to make available for lease and the leasing stipulations that should apply to lease areas.
2. The potential impacts of the land management plan alternatives on oil and gas leasing opportunities as reflected in alternatives for oil and gas leasing availability and stipulations on future leases. The principal factors that may affect projected oil and gas development are 1) lands designated as available or unavailable for leasing, and 2) restrictions on activities reflected by lease stipulations on lands available for leasing. For the latter, lease stipulations may affect development by imposing restrictions based on resource-specific protections.
3. The potential impacts to other resources and uses of the SJNF and TRFO (e.g., wildlife, riparian ecosystems, recreation, scenic quality, etc.) from oil and gas leasing based on RFD that could occur as a result of leasing. These potential effects are addressed within Sections 3.1 through 3.31 of this chapter.

Potential environmental consequences disclosed in this chapter are based on oil and gas leasing and projected development scenarios associated with each LRMP alternative described in Chapter 2.

The leasing analysis:

- Is based on a projection of the type and amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative (36 CFR 228.102(c)(3) and BLM Handbook H1624-1); and
- Evaluates the reasonable foreseeable impact of post-leasing activity projected for the proposal and for each alternative (36 CFR 228.102(c)(3) and BLM Handbook H1624-1).

Projected Development on Leased and Unleased Lands

There are important distinctions between projected future development of existing leases and development that is projected on lands that are currently unleased but that would be made available for lease in the ROD:

- Development on existing leases must be consistent with rights as granted under the existing leases. New leasing decisions would apply to currently leased lands only when the existing leases expire or are relinquished or terminated and the lands are again offered for lease. The current leaseholder(s) may develop its lease(s) during its 10-year term under Applications for Permit to Drill (APDs) authorized through required procedures, including NEPA analysis appropriate to the situation. Lease development must be fully compliant with applicable laws and regulations, e.g. the ESA.
- Lands that are currently unleased are subject to leasing availability and new lease stipulations approved in the ROD after the decision becomes effective and lands are nominated and offered for lease.

Throughout the analysis presented in this chapter, distinctions are made between projections of the types and amount of potential oil and gas development that may take place on land currently leased for oil and gas development and projections of potential oil and gas development on land not currently held by a lease. The distinction is also key to the No Leasing Alternative. In the planning area “no leasing” does not equate to “no development.” Even under a no leasing decision, oil and gas development activities may still proceed on lands currently leased under the terms and conditions of those leases. Projections of oil and gas development for Alternatives A through D are presented in Section 3.19 and are part of the activity basis for the environmental, social, and economic analyses presented in this chapter.

The potential oil and gas development of existing leases would be consistent with management plan direction and the terms and conditions of the lease. Impacts from future development on lands currently held under lease are generally subject to the terms and conditions under which they were originally leased.

Assumptions common to all alternatives and to the analysis that follows are listed below.

- Leasing and subsequent development activities would be implemented in compliance with the lease stipulations, standard practices, applicable BMPs, guidelines for surface-disturbing activities, and applicable laws, standards, policies, and implementation plans, as well as with all USFS and BLM jurisdiction, policies, and regulations. This assumption is embedded in the analysis of impacts. Applicable management requirements in addition to the lease stipulations and standards and guidelines are presented in each of the resource analysis sections that follow.
- Leaseholders have the right to explore, develop, and produce mineral resources from any valid existing lease, even if the area containing the lease were designated closed to future leasing or stipulated with NSO on future leases.
- Surface use restrictions, including TL, NSO, and CSU stipulations, as well as unavailable for leasing designations, cannot be retroactively applied to valid, existing oil and gas leases or use authorizations (e.g., APDs). Post-lease actions/authorizations (e.g., APDs, road/pipeline ROWs), however, could be encumbered by COAs with effects similar to TL and CSU restrictions on a case-by-case basis, as required through project-specific NEPA analysis or other environmental review. Application of COAs to operations on existing leases must be in accord with the authority reserved by the terms and conditions of the lease.

Actions Contributing to Oil and Gas Cumulative Effects

The cumulative effects analysis area includes five counties within the Paradox Basin in southwest Colorado. The area includes the SJNF, BLM-administered lands, state lands, and private lands within general proximity of the federal lands.

Oil and gas development would occur on both existing and future leases, and projections have been made of the amounts that would occur on each. The cumulative effects analysis considers the environmental consequences of both current and future oil and gas development and how such development would contribute to overall environmental impacts. Other activities analyzed that may interact with oil and gas development and contribute to cumulative impacts include rural and urban housing development, timber harvest, fire management, livestock grazing, recreation, agriculture, and the transportation systems expansion and use.

3.2 Terrestrial Ecosystems and Plant Species

3.2.1 Introduction

Terrestrial ecosystems on the SJNF and TRFO occur in upland landscape positions. These ecosystems are defined by soils, climate zones, and major vegetation types and are named for the major vegetation types that they represent. The pronounced elevational and topographic variability of the SJNF and TRFO has produced a great variety of terrestrial ecosystems, including spruce-fir forests, aspen forests, cool-moist mixed conifer forests, warm-dry mixed conifer forests, ponderosa pine forests, pinyon-juniper woodlands, mountain shrublands, sagebrush shrublands, semi-desert shrublands, mountain grasslands, semi-desert grasslands, and alpine (Redders 2012). Soils and native plant species, including special status plant species, are important components of terrestrial ecosystems that are analyzed here.

In order to better understand and evaluate current ecological conditions in the planning area, it can be helpful to look at conditions during a reference period. The reference period from 1500 to 1870 represents a time of relatively consistent environmental and cultural conditions in this region (Romme et al. 2009). Ecological conditions that existed during this time frame are referred to as reference conditions. The term “historic range of variability” (HRV) describes the range of ecological conditions (including vegetation structure and natural disturbance regimes) that occurred during the reference period. HRV information allows a comparison of whether current ecological conditions within the planning area are similar, or dissimilar, to the HRV conditions that occurred within the planning area in the past. The intent is not to manage the planning area exactly according to HRV conditions. The intent is to use HRV conditions as a context in order to help formulate attainable and sustainable desired conditions that meet a variety of management needs. HRV is described for each terrestrial ecosystem type later in this section. Sources of HRV information include McGarigal and Romme (2005) and Romme et al. (2009).

The concepts of terrestrial ecosystems and HRV are used in the LRMP and FEIS to describe ecosystem diversity; analyze past, current, and future ecological conditions; describe environmental impacts from management activities; address the legal, regulatory, and policy requirements for species diversity and population viability; and develop LRMP components (desired conditions, objectives, standards, and guidelines). Terrestrial ecosystems, which are an important part of the LRMP’s sustainable ecosystems strategy at the coarse filter level, also serve as broad-scale habitat types for terrestrial wildlife species, special status wildlife species, and Management Indicator Species (MIS). See the ecological framework section in Volume II, LRMP for more information on the sustainable ecosystems strategy.

Managing for sustainable terrestrial ecosystems would protect and sustain the diversity of these ecosystems and would protect the majority of species within them, but a complementary plant species strategy is needed for some species that may not be adequately protected by the sustainable ecosystems strategy. Special status plant species that occur on the SJNF and TRFO include federally

listed species, proposed species for federal listing, candidate species for federal listing, Region 2 Regional Forester's sensitive species, and Colorado BLM State Director's sensitive species. A list of the special status plant species known or suspected to occur on the SJNF and TRFO can be found in Volume III, Appendix P, along with a brief description of the habitats where they occur.

3.2.2 Existing Conditions and Trends

Terrestrial Ecosystems

The existing conditions of terrestrial ecosystems on the SJNF and TRFO are the result of various ecological processes, disturbance, and past management activities. Ecological processes and disturbances, including succession, fire, insects, disease, drought, and climate-related factors, have played a fundamental role in shaping the composition, structure, and function of terrestrial ecosystems at multiple scales and in creating the heterogeneous pattern of vegetation communities currently seen across the planning area. Ecological processes, disturbance, and management activities would continue to play a role in shaping terrestrial ecosystems over time. These factors, in concert with plant life cycles, would continue to create dynamic and heterogeneous terrestrial ecosystems across the SJNF and TRFO.

Terrestrial ecosystems can move from one development stage to another and can also convert from one type of terrestrial ecosystem to another. These functional and structural changes occur in response to the types of ecological processes, disturbances, and past management that influence the system (BLM 2013). For example, barring disturbance, many aspen stands would eventually convert to spruce-fir or cool-moist mixed conifer forests. In general, there is a lack of young development stages in all forested ecosystem types across the SJNF and TRFO and a lack of old growth in warm-dry mixed conifer, ponderosa pine (*Pinus ponderosa*), and pinyon pine (*P. edulis*). Tables 2.2.1 (SJNF) and 2.2.2 (TRFO) in Volume II, LRMP show the current range of development stages for the various forested terrestrial ecosystems. Early or mid-seral stages tend to be over-represented and late successional stages under-represented in the non-forested terrestrial ecosystems of the SJNF and TRFO, especially at lower elevations.

Agents of change most influential on terrestrial ecosystems in the SJNF and TRFO are fire, insects and disease, drought, past and present management actions, and a changing climate. Studies conducted across the Southwest (Covington and Moore 1994; Swetnam 1990; Swetnam and Baisan 1996; Touchan et al. 1996) and on the SJNF and TRFO (Brown and Wu 2005; Romme et al. 1997; Wu 1999) have shown that fire has always played an important role on the SJNF and TRFO. Fires can occur at many intensities and scales, from a small fire that causes the death of a single tree to a high intensity and on the SJNF and TRFO. Many researchers (e.g., Brown and Wu 2005; Romme et al. 1997; Wu 1999) have shown that fire has always played an important role on the SJNF and TRFO. Fires can occur at many intensities and scales, from a small fire that causes the death of a single tree, to a high-intensity fire that impacts thousands of acres. Fire regimes, which describe the historic frequency, extent, intensity, severity, and seasonality of fires within an ecosystem, are discussed in more detail under the description of each terrestrial ecosystem and in Section 3.11, Fire and Fuels Management of this FEIS.

In the past 10 years many more trees have been killed, and a larger area impacted, by insects and disease than by fire (Rocky Mountain Region 2010). From 2001 to 2004, a pinyon Ips beetle (*Ips confusus*) epidemic killed up to 90% of pinyon pine trees in the pinyon-juniper woodlands of southwest Colorado (Colorado Department of Natural Resources 2005). In addition, the ongoing spruce beetle (*Dendroctonus rufipennis*) outbreak that started in 1996 has killed most of the overstory

and midstory Engelmann spruce (*Picea engelmannii*) across an estimated 130,000 acres on the eastern side of the SJNF (Rocky Mountain Region 2012). Insects and disease are discussed in more detail in Section 3.10, Insects and Disease of this FEIS.

Drought is another disturbance agent that can have an influence on ecosystems. This can range from seasonally dry periods every June to moderate or long-term droughts that have much broader influences in the Southwest. For example, El Niño and La Niña cycles can result in multi-year drought periods. Multi-decadal drought periods can cause dramatic changes over large areas. These longer drought periods often interplay with bark beetle or wildfire cycles. Conversely, wet cycles can result in increased forest vegetation growth rates, leading to increasing risks for defoliating insects or for elevated bark beetles when drought periods return.

Climate change is also impacting terrestrial ecosystems in the planning area. Recent research and species distribution modeling predict large changes in the distributions of species and vegetation types in the western interior of the United States in response to climate change. Examples of changes to terrestrial ecosystems from climate change within the next 15 years include a decrease in alpine and spruce-fir forests and an increase in mixed conifer forests and pinyon-juniper woodlands (Finch 2012). Terrestrial ecosystem plant species (including special status plant species) responses to climate change would depend not only on their physiological tolerances but also on their phenology, establishment properties, biotic interactions, and capacity to evolve and migrate. The capacity of terrestrial ecosystem species and, thus, their distributions to respond to a warming environment would also be affected by changing disturbance regimes and other global change factors (Turner 2010).

In addition to succession and disturbance agents, past management activities have had a significant impact on the existing conditions of the terrestrial ecosystems of the SJNF and TRFO. Romme et al. (2009) found that many of the terrestrial ecosystems on the SJNF and TRFO are substantially different from the ecosystems that existed during the reference period, primarily due to changes that have come about through human activities during the last century. The magnitude and causes of change vary greatly among the different terrestrial ecosystems, but in general, the terrestrial ecosystems at lower elevations on the SJNF and TRFO have experienced more impacts from past management activities for a longer period of time than terrestrial ecosystems at higher elevations. For instance, livestock grazing at the lower elevations has significantly altered species diversity and distribution of native grasses in mountain grasslands, semi-desert shrublands, semi-desert grasslands, sagebrush shrublands, and pinyon-juniper woodlands as compared to reference period conditions. In addition, the stand structure of many ponderosa pine and warm-dry mixed conifer forests was significantly altered by fire exclusion, livestock grazing, and timber harvest that began in the mid-1800s (Romme et al. 2009). These activities resulted in forests that are currently outside their HRV in terms of vegetation stand structure and fire frequency (Grissino-Mayer et al. 2004; Romme et al. 2009).

In contrast, many of the terrestrial ecosystems at higher elevations have been little altered by past management activities, except in specific locations such as in spruce-fir or cool-moist mixed conifer stands where logging and road building have occurred, or in alpine areas impacted by sheep grazing, recreation, or mining. Approximately 47% of terrestrial ecosystems on the SJNF and TRFO (a majority of which is at higher elevations) are found within large, mostly unaltered, unroaded areas including wilderness areas, WSAs, lands managed for wilderness charateristics, the Piedra Area, RNAs, and CRAs. Collectively, these areas are described as protected areas. For the most part, ecosystem processes and disturbance agents have been allowed to occur and influence the terrestrial ecosystems and plant species within these protected areas with minimal human

intervention. Table 3.2.1 shows the distribution of terrestrial ecosystems within protected areas on the SJNF and TRFO.

Table 3.2.1: Current Distribution of Terrestrial Ecosystems in Protected Areas

Terrestrial Ecosystems	Acres of Terrestrial Ecosystem Planning Area-wide (SJNF and TRFO)	Protected Areas	Percent (%) within Protected Areas
Alpine	171,868	150,996	88
Spruce-fir	508,825	367,043	72
Aspen (both pure aspen and aspen with conifer	298,709	172,477	58
Cool-moist mixed conifer	135,788	103,737	76
Warm-dry mixed conifer	116,407	62,484	54
Mountain grassland	140,127	58,285	42
Mountain shrubland	241,386	67,016	28
Ponderosa pine	259,179	45,124	17
Pinyon-juniper	216,865	24,863	11
Semi-desert shrubland	53,334	5,191	10
Semi-desert grassland	15,395	914	6
Sagebrush	95,931	4,522	5
Total	**2,253,814**	**1,062,652**	**47%**

Special Status Plant Species

There are currently 38 special status plant species on the SJNF and TRFO. This includes three federally listed species, one candidate for federal listing, and 34 sensitive species. Designated critical habitat for one of the federally listed plant species also occurs on TRFO and SJNF lands. A list of the federally listed and candidate plant species known to occur or with suitable habitat in the planning area is given below, along with a brief description of habitat for these species.

- **Pagosa skyrocket** (*Ipomopsis polyantha*) is an endangered species found on Mancos Shale soils in Archuleta County, Colorado. There is one known population of this species on TRFO lands. There are no known populations on the SJNF, but there is suitable habitat (USFWS 2011b). The USFWS has designated four critical habitat units for Pagosa skyrocket; two are occupied, and two are unoccupied. One of the occupied critical habitat units is on TRFO land. The two unoccupied critical habitat units occur on SJNF lands (USFWS 2012a).
- **Knowlton's cactus** (*Pediocactus knowltonii*) is an endangered cactus known from one population on rolling, gravelly hillsides in a pinyon-juniper woodland between 6,200 to 6,300 feet in elevation (USFWS 2010). There are no known populations of this species within the planning area, but there is suitable habitat on both SJNF and TRFO lands in Archuleta and La Plata Counties (Glenne 2013).
- **Mesa Verde Cactus** (*Sclerocactus mesae-verde*) is a threatened cactus restricted to sparsely vegetated badlands of the Fruitland and Mancos Shale formations in Montezuma County, Colorado, and San Juan County, New Mexico (USFWS 2011a, 2013a). There are no known populations of this species within the planning area, but there is habitat for this species on TRFO lands (USFWS 2011a).
- **Schmoll's milkvetch** (*Astragalus schmolliae*) is a candidate species found in dense pinyon-juniper woodlands in the Mesa Verde area in Montezuma County, Colorado (Friedlander 1980).

There are no known populations of this species within the planning area, but there is suitable habitat on TRFO lands in Montezuma and La Plata Counties (Anderson 2004).

A list of the 34 sensitive plant species known to occur or with habitat on the SJNF and TRFO can be found in Volume III, Appendix P, along with a brief description of the habitats where they occur. Of the 34 sensitive plant species known to occur, 16 occur within areas well represented in protected areas (including fens, high-elevation wetlands, and alpine habitat). The remaining 18 species are found at lower elevations in habitats poorly represented or entirely absent from protected areas. This includes, but is not limited to, hanging gardens, low-elevation riparian areas and wetlands, and specific soil types such as gypsum and shale soils.

Soils and Biological Soil Crusts

The SJNF and TRFO encompass a large variety of soil types that support diverse terrestrial ecosystems. Certain soil types are more likely to be affected by management activities. Timber harvest, mechanical fuels treatments, and prescribed fire generally occur in terrestrial ecosystems with soils that occur on slopes less than 35%, classify as Alfisols or Inceptisols, are moderately well to very well drained, are moderately deep to very deep, have low to moderate soil erosion potential, and have litter and organic matter-rich surface horizons that help to minimize soil erosion and soil compaction. Terrestrial ecosystems affected by oil and gas development have soils that are moderately well to very well drained, classify mostly as Haplustalfs and Haplustepts, and have moderate to high soil erosion potential. Terrestrial ecosystems soils of particular management concern occur on Morrison, Mancos Shale, Lewis, and Fruitland geologic formations; lands with slopes greater than 35%; and lands that are highly susceptible to mass movement or excessive sheet erosion. Gypsum soils are considered a unique and rare soil in the planning area.

Biological soil crusts are the community of organisms living at the surface of semiarid and arid environments where vegetative cover is generally sparse (U.S. Geological Survey [USGS] 2006). Open spaces in these environments are usually covered by biological soil crusts, a highly specialized community of cyanobacteria, mosses, and lichens. Biological soil crusts are major ecosystem components of lower-elevation terrestrial ecosystems, including pinyon-juniper woodlands, sagebrush shrublands, semi-desert shrublands, and semi-desert grasslands. Biological soil crusts play important roles in terrestrial ecosystem structure and function, including soil stability and erosion, atmospheric nitrogen-fixation, nutrient contributions to plants, soil-plant-water relations, infiltration, seedling germination, and plant growth (USGS 2006). These crusts are well adapted to severe growing conditions, but poorly adapted to compressional disturbances such as domestic livestock grazing and off-road driving (USGS 2006). These activities, which disturb the surface of the soil, impact the integrity of the crusts, resulting in decreased organism diversity, soil nutrients, stability, and organic matter (USGS 2006).

Currently, soil productivity is generally intact in the forested terrestrial ecosystems of the SJNF and TRFO, and most of the soils-related terrestrial ecosystem desired conditions in the LRMP are being met in those areas. However, in pinyon-juniper woodlands and other non-forested lower-elevation terrestrial ecosystems, soil productivity has been impacted by past management activities. Soil loss has occurred and biological soil crusts occur much less frequently than expected on those sites, resulting in loss of soil productivity and soil stability.

3.2.3 Terrestrial Ecosystem Types

Descriptions of terrestrial ecosystems on the SJNF and TRFO are given below and include descriptions of soils, current conditions of vegetation within the ecosystems, conditions during the

reference period, descriptions of important disturbance agents, and information regarding HRV. Map 6 in Volume III, Appendix V illustrates the distribution of major vegetation types on the SJNF and TRFO.

Spruce-fir forests occur on mountains and tablelands at elevations ranging from about 9,000 to 11,500 feet. They are associated with the subalpine climate zone, the cryic soil temperature regime, and the udic soil moisture regime. The major soil types are Haplocryalfs and Dystrocryepts. Engelmann spruce and subalpine (*Abies lasiocarpa*) or corkbark fir (*A.l.* var. *arizonica*) trees are present in most stands. Douglas-fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*) occur with Engelmann spruce and subalpine fir on the warmest and driest sites at the lowest elevations within this type, and Engelmann spruce occurs alone on the coldest and wettest sites at the highest elevations within this type. Aspen (*Populus* sp.) is a seral species that is often abundant. High-elevation spruce-fir forest can also have bristlecone (*Pinus aristata*) or limber pine (*P. flexilis*), but these species are typically rare. Spruce-fir forests succeeded from aspen forests or developed directly from the regeneration of Engelmann spruce and subalpine fir trees following a disturbance event in a spruce-fir forest (DeVelice et al. 1986; Veblen et al. 1991), the latter often taking decades. Currently, most spruce-fir forests on the SJNF and TRFO are in the mature or old growth development stages (due in part to fire exclusion), which differs from HRV conditions that had more spruce-fir forests in the young and mid-development stages. However, the ongoing spruce beetle (*Dendroctonus rufipennis*) outbreak that started in 1996 has killed most of the overstory and midstory Engelmann spruce across an estimated 130,000 acres on the eastern side of the SJNF. The seedling, sapling, and small pole-sized spruce in the understory of most of these stands have not been impacted, so these stands would now be considered to be in the young or mid-development stages.

The fire regime for spruce-fir forests during the reference period was dominated by infrequent, high-severity, stand-replacement fires driven by regional-scale climate associated with prolonged drought and high winds (Buechling and Baker 2004; Romme et al. 1997; Sibold et al. 2006). Fire frequency was longer than 200 years. During the long periods between fires, chronic fine-scale disturbances (including insects, disease, and wind) killed individual trees or small groups of trees (Veblen et al. 1991). The current fire-free interval seen in the spruce-fir within the planning area does not appear to be far outside the range of variability in fire intervals that characterized the reference period (Romme et al. 2009).

Aspen forests occur on mountains, hills, and tablelands at elevations ranging from about 7,500 to 11,200 feet. They are associated with the subalpine and montane climate zones, the cryic and frigid soil temperature regimes, and the udic soil moisture regime. The major soil types are Haplocryolls and Haplustolls. Aspen forests include pure stands of aspen trees, aspen-dominated stands with conifer trees as minor or major understory components, and aspen stands in which aspen and conifer trees are co-dominant in the overstory. Conifers include Engelmann spruce and subalpine fir at the higher elevations and white fir, Douglas-fir, blue spruce (*Picea pungens*), and ponderosa pine at the lower elevations within this type. Most aspen forests on within the planning area are seral communities that would succeed to spruce-fir or cool-moist mixed conifer forests within the next 100 years, while other aspen forests are stable communities that would remain aspen forests for at least the next 100 years (DeVelice et al. 1986). Aspen forests developed from stand replacement fires in spruce-fir forests, cool-moist mixed conifer forests, or aspen forests.

Currently, most aspen forests within the planning area are in the mature or old growth development stages, due in part to fire exclusion, which differs from reference period conditions that had more aspen forests in the young and mid-development stages. Aspen forests at elevations of about 7,000

to 8,500 feet have experienced rapid tree mortality due to sudden aspen decline caused by a combination of high temperatures and drought (Anderegg et al. 2012; Worrall et al. 2013). This has weakened the aspen trees and made them more susceptible to mortality from cytospora canker, aspen bark beetles, and poplar borers (Worrall et al. 2008).

The fire regime for aspen forests during the reference period was dominated by infrequent, high-severity, stand-replacement fires (Kulakowski et al. 2004; Veblen et al. 1994) with a fire frequency of about 144 years (Romme et al. 2001).

Cool-moist mixed conifer forests occur on mountains and tablelands at elevations ranging from about 8,500 to 10,000 feet. They occur on cooler and wetter sites (usually at higher elevations) compared to warm-dry mixed conifer forests. They are associated with the montane climate zone, the frigid soil temperature regime, and the udic soil moisture regime. The major soil types are Hapludalfs and Dystudepts. Douglas-fir and white fir are the dominant tree species. Engelmann spruce and subalpine fir trees may be present as minor components on the colder and wetter sites within this type. Blue spruce fills a similar niche as Engelmann spruce at lower elevations in this type. Aspen is a seral species that is often abundant. Ponderosa pine and Gambel oak (*Quercus gambelii*) are absent or very minor components. Cool-moist mixed conifer forests succeeded from aspen forests, developed directly from the regeneration of white fir, Douglas-fir, or the other tree species noted above following a disturbance event in a cool-moist mixed conifer forest.

Currently, most cool-moist mixed conifer forests within the planning area are in the mature development stage (due in part to fire exclusion) which differs from HRV conditions that had more cool-moist mixed conifer forests in the young and mid-development stages. The high proportion of larger, older trees, coupled with similar conditions in warm-dry mixed conifer, has led to high endemic levels of western spruce budworm (*Choristoneura occidentalis Freeman*), with localized epidemics. Repeated defoliation of recent growth has often resulted in topkill or outright mortality in the younger age classes of white fir, Douglas-fir, and associated spruce.

The fire regime for cool-moist mixed conifer forests during the reference period was dominated by infrequent, high-severity, stand-replacement fires similar to that of spruce-fir forests or by mixed-severity fire resulting in highly variable forest conditions (Romme et al. 2009). Fire frequency was 144 years (McGarigal and Romme 2005). The current fire frequency regime of the cool-moist mixed conifer forest type is within the HRV.

Warm-dry mixed conifer forests occur on mountains, hills, and tablelands at elevations ranging from about 7,500 to 9,000 feet. They occur on warmer and drier sites (usually at lower elevations) compared to cool-moist mixed conifer forests. They are associated with the montane climate zone, the frigid soil temperature regime, and the ustic soil moisture regime. The major soil types are Hapludalfs and Dystudepts. Ponderosa pine, Douglas-fir, and/or white fir trees are the dominant species. Aspen is highly variable, from substantial to minimal cover. Blue spruce can be a minor component; southwestern white (*Pinus strobiformis*) or limber pine is infrequent to rare. Gambel oak is a seral species that often displays high cover. Warm-dry mixed conifer forests succeeded from ponderosa pine or mountain shrublands, or developed directly from the regeneration of ponderosa pine, white fir, and Douglas-fir trees following a disturbance event in a warm-dry mixed conifer forest. Currently, most warm-dry mixed conifer forests within the planning area are in the mature development stage due in part to fire suppression.

The fire regime for warm-dry mixed conifer forests within the planning area during the reference period was driven by regional-scale climate associated with prolonged drought (Swetnam and Betancourt 1990). The fire regime was of mixed-severity (Romme et al. 2009), but was dominated by

frequent, low-severity fires with a frequency of about 18 to 41 years (Grissino-Mayer et al. 2004). The more frequent low-severity fires consumed litter, dead wood, small trees, and the aboveground portions of shrubs and herbs (Covington and Moore 1994), creating uneven-aged stands with low tree densities and open canopy covers (Romme et al. 2009). Less frequent, high-severity, stand-replacement fires created stands that were more even-aged with higher tree densities and more closed canopy covers (Ehle and Baker 2003; Kaufmann et al. 2000).

Many of the warm-dry mixed conifer forests within the planning area were dramatically altered during the last century due initially to livestock grazing introduced by Euro-American settlers in the late 1800s (Grissino-Mayer et al. 2004; Landres et al. 1999). Unregulated livestock grazing decreased the abundance and distribution of the native bunchgrasses that helped carry surface fire through these forests. Beginning in the early 1900s, logging reduced the abundance and distribution of very large (and often very old) ponderosa pine and Douglas-fir, while leaving white fir. The combination of grazing and logging resulted in an abundance of growing space during a period of greater than normal precipitation, which then coincided with a significant pulse of ponderosa pine seed production (around 1920). Young, very dense, ponderosa pine forests sprung up from these interrelated actions and historic events, with fire suppression helping to sustain these dense conditions.

Collectively, these impacts have led to 1) a reduction in the frequency of low-severity fires that burned in these forests, 2) an abundance of stands with high stem densities, 3) elevated risks for insects and disease, particularly bark beetles, and 4) heavy fuel loads, both in aerial (dense canopies) and ground fuels. Composition has changed as well. These dense forests have favored the proliferation of more shade-tolerant white fir and greatly inhibited regeneration of shade-intolerant ponderosa pine and, to a lesser extent, Douglas-fir (Moir et al. 1997; Wu 1999). The increased abundance of white fir in the understories and midstories of these stands has led to extensive ladder fuels, providing ready avenues for ground fires to transition into canopies. The activities and events described above have also contributed to a reduction in the amount of warm-dry mixed conifer old growth forests as compared to what would be expected under the HRV.

In summary, the stand structure and composition of many warm-dry mixed conifer forests have been greatly altered due to past unregulated and regulated management activities, as compared to these forests during their reference period (Colorado Forest Restoration Institute 2010; Grissino-Mayer et al. 2004; Romme et al. 2009). Epidemic-level insect and disease infestations are occurring or remain at high risk for occurrence. Most warm-dry mixed conifer within the planning area has missed from five to eight fire cycles as compared to fire frequencies in the reference period. This makes these stands at greater risk for high-intensity, stand-replacement fires (Covington and Moore 1994) that are increasingly difficult to control (Moir et al. 1997).

Ponderosa pine forests occur on mountains, hills, and tablelands at elevations ranging from about 7,000 to 8,500 feet. They are associated with the lower-montane climate zone, the frigid soil temperature regime, and the ustic soil moisture regime. The major soil types are Haplustalfs and Haplustepts. This type consists of relatively pure stands of ponderosa pine trees. Rocky Mountain juniper (*Juniperus scopulorum*), white fir, Douglas-fir, blue spruce, or pinyon pine trees may be present as minor components. Gambel oak, which is a seral species, often displays high cover. Arizona fescue (*Festuca arizonica*) and mountain muhly (*Muhlenbergia montana*) are important bunchgrasses. Ponderosa pine forests succeeded from mountain shrublands or developed through the cycle of regeneration of ponderosa pine trees following disturbance (typically fire) in a ponderosa pine forest (DeVelice et al. 1986; Kaufmann et al. 2000). Currently, most ponderosa pine forests within the planning area are in the mature development stage.

The fire regime for ponderosa pine forests within the planning area during the reference period was one of high frequency, low-severity surface fires (Romme et al. 2009). These fires occurred about every 12 to 18 years (Grissino-Mayer et al. 2004), consuming litter, dead wood, small trees, and the aboveground portions of shrubs and herbs (Covington and Moore 1994). This created uneven-aged stands that typically exhibited low tree densities and open canopy covers (Romme et al. 2009). Generally, the uneven-aged stands were composed of even-aged clumps alternating with herbaceous-dominated openings. This pattern of tree clumps and openings resulted in multiple gaps in tree canopy layers that kept crown fires to a minimum.

Many ponderosa pine forests were dramatically altered by livestock grazing, fire suppression, and logging. These effects of these activities are similar to those described under warm-dry mixed conifer. Unregulated livestock grazing decreased the abundance and distribution of the native bunchgrasses (such as Arizona fescue, Parry's oatgrass [*Danthonia parryi*], and mountain muhly) that helped carry surface fire through these forests. Beginning in the early 1900s, logging reduced the abundance and distribution of very large (and often very old) ponderosa pine and Douglas-fir. These effects, combined with the significant pulse of ponderosa pine seed production around 1920, led to the establishment of young, very dense, ponderosa pine forests across much of the pine-dominated landscape, with fire suppression helping to sustain these dense conditions. The activities and events described above have also contributed to a reduction in the amount of ponderosa pine old growth forests as compared to what would be expected under the HRV.

In summary, the stand structure of many ponderosa pine forests have been greatly altered due to past unregulated and regulated management activities, as compared to these forest during the reference period (Colorado Forest Restoration Institute 2010; Grissino-Mayer et al. 2004; Romme et al. 2009). The risk for epidemic-level insect and disease infestations—particularly western (*Dendroctonus brevicomis*) and/or mountain pine beetle (*D. ponderosae*)—remains high. Most ponderosa pine forests within the planning area have missed from seven to 11 fire cycles as compared to fire frequencies in the reference period and, hence, are at a higher risk for high-intensity, stand-replacement fires (Covington and Moore 1994) that are increasingly difficult to control (Moir et al. 1997).

Pinyon-juniper woodlands occur on mountains, hills, and tablelands at elevations ranging from about 5,500 to 7,500 feet. They are associated with the semiarid climate zone, the mesic soil temperature regime, and the ustic soil moisture regime. The major soil types are Haplustalfs and Haplustepts. Pinyon pine, Utah juniper (*Juniperus osteosperma*), and Rocky Mountain juniper are present in these woodlands in differing amounts, depending on environmental factors (such as elevation and precipitation) and past disturbance (such as the pinyon Ips epidemic of the early 2000s). Ponderosa pine trees may be present as a minor component, and big sagebrush (*Artemisia tridentata*) and Gambel oak are present in varying amounts. Pinyon-juniper woodlands within the planning area, which are highly variable in stand structure, range from old growth stands that escaped fire for centuries (Floyd et al. 2004), to young stands that have regenerated after chaining treatments in the 1970s, to other stands that exhibit structural stages in between those two extremes. Biological soil crusts are significant components on the ground surface of some of these woodlands at site potential. Historic fire intervals in pinyon-juniper woodlands vary, depending on a stands canopy structure and understory characteristics. Persistent pinyon-juniper woodlands, which are the most common type of pinyon-juniper found within the planning area, appeared to have the longest fire rotations, while fire intervals in pinyon-juniper shrublands were shorter (Romme et al. 2009).

Currently, many pinyon-juniper woodlands within the planning area differ significantly from their HRV conditions due to livestock grazing, which decreased the diversity, abundance, and distribution of

native grasses. At the landscape scale, there are also fewer acres of old growth in pinyon-juniper woodlands than compared to reference period conditions. Within the next 15 years, natural succession would convert some mountain shrublands to the pinyon-juniper woodlands and would move some pinyon-juniper woodlands to later successional stages, but this would not result in a major change in the abundance or distribution of the pinyon-juniper type or its development stages. There has also been an increase in cheatgrass (*Bromus tectorum*) in the understory of many pinyon-juniper stands. Cheatgrass readily carries fire and is a contributing factor to the larger fires seen in the pinyon-juniper woodlands in recent years (Romme et al. 2009). Within the next 15 years, wildfire could convert many pinyon-juniper woodlands to mountain shrublands.

Mountain shrublands occur in the lower-montane and montane climate zones at elevations ranging from about 6,000 to 9,000 feet. They are often found on steep slopes with southerly aspects. They are associated with the mesic soil temperature regime and the ustic soil moisture regime. The major soil types are Haplustalfs and Haplustepts. The mountain shrubland type includes relatively pure stands of Gambel oak and mixed stands that include Gambel oak and other deciduous shrubs, including mountain mahogany (*Cercocarpus montanus*), serviceberry (*Amelanchier* sp.), chokecherry (*Prunus virginiana*), antelope bitterbrush (*Purshia tridentata*), fendlerbush (*Fendlera rupicola*), and squawapple (*Peraphyllum ramosissimum*). Pinyon pine, Utah juniper, Rocky Mountain juniper, ponderosa pine, white fir, or Douglas-fir trees may be present as minor components.

The fire regime for mountain shrublands within the planning area during the reference period consisted mostly of high-severity fires with a fire frequency of 37 to 100 years (Floyd et al. 2004; McGarigal and Romme 2005). Within the next 15 years, natural succession would convert some mountain shrublands to pinyon-juniper woodlands, ponderosa pine forests, or warm-dry mixed conifer forests, but that would not result in a major change in the abundance and distribution of the mountain shrubland type within the planning area. Within the next 15 years, wildfire could convert some warm-dry mixed conifer forests, ponderosa pine forests, or pinyon-juniper woodlands to mountain shrublands. Wildfire in mountain shrublands would perpetuate mountain shrublands.

Mountain grasslands occur throughout the planning area at elevations ranging from about 7,500 to 11,600 feet. They are associated with the montane and subalpine climate zones. The major soil types are Haplustolls and Haplocryolls. The general mountain grassland type includes a cool-season bunchgrass community often dominated by Arizona fescue at the lower elevations, cool-season bunchgrass communities often dominated by Thurber's fescue (*Festuca thurberi*) higher elevations, and a plant community dominated by the rhizomatous non-native Kentucky bluegrass (*Poa pratensis*) that can occur throughout the montane and subalpine zones. Sites in good ecological condition display high canopy cover of fescues and other bunchgrasses, low amounts of bare soil, and high amounts of litter. Sites in poor ecological condition display low canopy cover of bunchgrasses, low amounts of litter, high amounts of bare soil, high cover of Kentucky bluegrass, high cover of native increaser forbs, and soil erosion and soil compaction problems.

There is little scientific information on reference period conditions for mountain grasslands, but based on reference sites within the planning area and throughout the South Central Highlands Section, mountain grasslands during the reference period apparently reflected good ecological condition as described above (Romme et al. 2009). The historic fire regimes for the Arizona and Thurber's fescue mountain grassland types were likely of mixed severity with a fire frequency of about 10 to 15 years (LANDFIRE biophysical setting model 2811460) for the former and about 100 years (LANDFIRE biophysical setting model 2811460) for the latter. The high canopy cover of bunchgrasses and high amounts of litter allowed fires to burn through those grasslands (Romme et al. 2009; Touchan et al. 1993). Currently, many Thurber's fescue mountain grasslands and some Arizona fescue mountain

grasslands within the planning area display characteristics similar to those of the reference period. Some of the Thurber's fescue type, most of the Arizona fescue type, and all of the Kentucky bluegrass type have altered successional pathways and a composition, structure, and function that differs significantly compared to what would be expected under the HRV.

Sagebrush shrublands occur on hills, mesas, and valley floors at elevations ranging from about 5,000 to 9,000 feet. They occur primarily in the semiarid and lower-montane climate zones. The major soil types are Haplustalfs, Haplustepts, Torriorthents, and Natrargids. The general sagebrush shrubland type includes a basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) plant community that tends to occur on valley floors with deep soils, a black sagebrush (*A. nova*) plant community that tends to occur on shallow, alkaline soils with high clay contents, and a Wyoming big sagebrush (*A.t.* ssp. *wyomingensis*) plant community that tends to occur in more upland landscape positions. Biological soil crusts are significant components on the ground surface of some sagebrush shrublands. The historic fire regime for sagebrush shrublands within the planning area was likely of mixed severity with a fire frequency of about 80 years (LANDFIRE biophysical setting models 2810640 and 2811250). Currently, sagebrush shrublands are less abundant within the planning area compared to the reference period (McGarigal and Romme 2005), and many sagebrush shrublands in western Colorado (including those within the planning area) are in poor condition due to long-term livestock grazing, which has decreased native herbs, decreased litter, increased bare soil, and caused soil erosion (Winward 2004).

Semi-desert shrublands, which include saltbush-greasewood plant communities, occur on hills, alluvial flats, terraces, and valley floors in the semiarid climate zone at elevations ranging from about 4,500 to 7,000 feet. Soils, which are often calcareous or sodic, are mostly well drained but some flood intermittently. The major soil types are Torriorthents and Natrargids. Common shrubs in this type include shadscale saltbush (*Atriplex confertifolia*), fourwing saltbush (*A. canescens*), winterfat (*Krascheninnikovia lanata*), rubber rabbitbrush (*Ericameria nauseosa*), spiny hopsage (*Grayia spinosa*), greasewood (*Sarcobatus vermiculatus*), and basin big sagebrush. Biological soil crusts are major components on the ground surface in most semi-desert shrublands. Currently, based on reference sites, historic records, and soils information within the planning area, much of the semi-desert shrubland type appears to differ significantly from conditions seen during the reference period due to long-term livestock grazing which decreased the diversity, abundance, and distribution of native grasses, decreased litter, increased bare soil, and increased invasive plant species. The historic fire regime was likely of mixed severity with a fire frequency of greater than 200 years (LANDFIRE biophysical setting model 2811530).

Semi-desert grasslands occur on hills, alluvial flats, terraces, and valley floors in the semiarid climate zone at elevations ranging from about 4,500 to 7,000 feet. The major soil types are Torriorthents and Natrargids. This type is dominated by cool- and warm-season grasses including needle and thread (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*), galleta (*Pleuraphis* sp.), western wheatgrass (Pascopyrum smithii), blue grama (*Bouteloua gracilis*), purple threeawn (*Aristida purpurea*), sand dropseed (*Sporobolus cryptandrus*), and alkali sacaton (*S. airoides*). Biological soil crusts are major components on the ground surface in most semi-desert grasslands. Currently, based on reference sites, historic records, and soils information within the planning area, much of the semi-desert grassland type appears to differ significantly from its HRV conditions due to long-term livestock grazing, which decreased the diversity, abundance, and distribution of native grasses, decreased litter, increased bare soil, and increased invasive plant species. The historic fire regime was likely of mixed severity with a fire frequency ranging from about 35 to 75 years (LANDFIRE biophysical setting model 2811350).

Alpine terrestrial ecosystems occur on the mountains in the alpine life zone (Mutel and Emerick 1984) at elevations above 11,500 feet. The alpine life zone is characterized by long winters, snow, high wind, intense sunlight, short growing seasons, high vegetation diversity, and small-scale ecological processes including nivation (sub-snow patch processes), and solifluction (mass wasting of waterlogged soil, generally over frozen ground). Alpine landscapes were shaped by large-scale geomorphic processes including glaciation, resulting in lands that are both steep and rugged, and flat and smooth. The alpine major vegetation type, soils, elevation, and microclimate are used to describe alpine terrestrial ecosystem community types on the SJNF and TRFO (Redders 2012). Alpine terrestrial ecosystem community types in the planning area include turf, which is an herbaceous type that is associated with moderately well-drained soils that classify as Typic Dystrocryepts, and include Elynoid sedge, kobresia (*Kobresia* sp.), and alpine avens (*Geum rossii*) subcommunities; fellfield, which is an herbaceous type that occurs on wind-swept sites, is primarily associated with shallow, rocky, well-drained soils that classify as Lithic Dystrocryepts and is dominated by cushion plants (forbs); dwarf willow, which is a low shrubland type dominated by alpine willow (*Salix petrophila*) and/or net willow and is associated with moderately well drained soils that classify as Typic Dystrocryepts; upland willow, which is a tall shrubland type that occurs on mountain side slopes, is associated with somewhat poorly drained soils that classify as Oxyaquic Dystrocryepts, and displays a high canopy cover of planeleaf willow (*Salix planifolia*) and/or shortleaf willow (*Baccharis brachyphylla*); and Krummholtz, which is a forest type dominated by stunted Engelmann spruce trees that occurs between the spruce-fir forests of the subalpine zone and the treeless alpine zone, and is associated with moderately well-drained and shallow to moderately deep soils that classify mostly as Lithic Dystrocryepts.

Management activities that have had the most impact on alpine terrestrial ecosystems over the last century are sheep grazing, mining, and recreation use. Historic records indicate that during the peak of sheep use between 1910 and 1930, there were areas of overstocking and heavy use that were causing negative impacts to vegetation. Some soil erosion was also occurring along heavily used stock trails. The impacts of historic sheep use on vegetation and evidence of erosion on heavily used trailing routes is still visible in some areas, but in areas that are no longer used for sheep grazing, these impacts are becoming less and less obvious. Mining and associated road building have impacts to alpine ecosystems, particularly in the Silverton area. Recreation use in alpine areas has increased in recent decades, due both to hiking along system trails and cross-country travel. These impacts are generally confined to very limited areas, but repeated use can result in soil erosion along these routes.

3.2.4 Environmental Consequences

Direct and Indirect Impacts

Management activities that could have impacts on terrestrial ecosystems, special status plant species, and soils on the SJNF and TRFO include fire management, timber harvest, mechanical fuels treatments, oil and gas development, solid minerals development, livestock grazing, and recreation. Those impacts would depend on many factors, including the extent, timing, frequency, and duration of the activity. Adverse impacts to terrestrial ecosystems, special status plant species, and soils from management activities would be minimized or prevented by the implementation of standards, guidelines, and stipulations in the LRMP and project-specific mitigation measures, and by following direction in the Watershed Conservation Practices Handbook (Forest Service Handbook [FSH] 2509.25), the ESA, BLM Colorado's Standards for Public Land Health (Standards 3 and 4), BLM Colorado's Guidelines for Livestock Grazing Management, BLM Manual 6840 (Special Status Species Management), BLM Manual 6840.06, Surface Operating Standards and Guidelines for Oil

and Gas Exploration and Development (“The Gold Book” [BLM and USFS 2007]), Forest Service Manual (FSM) 2622, and FSM 2070).

Indicators would be used to analyze the environmental consequences to terrestrial ecosystems from management activities. Indicators are important ecological components or aspects of terrestrial ecosystems needed to maintain ecosystem integrity and help to ensure species diversity and population viability. Physical and biological indicators include, but are not limited to, changes in soil conditions, changes to forested stand structure and distribution, the abundance and distribution of desirable native plant species, impacts to special status plant species and other rare plant species, and changes to the extent and distribution of invasive plants.

Fire Management

Management-ignited fires, wildfires, and fire suppression have impacts to terrestrial ecosystems, special status plant species, and soils. Prior to Euro-American settlement, fire played an important role in creating and maintaining the vegetation communities in many terrestrial ecosystems, especially ponderosa pine and warm-dry mixed conifer forests. Fire suppression has contributed to the many changes seen in these ecosystems over the past 100 years. The use of management-ignited fires and the appropriate management of naturally ignited wildfires would help restore the composition and structure of ecosystems and maintain or restore the heterogeneous structure and pattern of the vegetation that was present on the SJNF and TRFO during the reference period. Management-ignited fires are also used for fuels reduction, wildlife habitat improvement, and range betterment.

The amount of area impacted per year by management-ignited fires varies considerably, but averages around 3,000 to 7,000 acres per year on the SJNF and 1,000 to 2,000 acres per year on TRFO lands. Most management-ignited fires are low to moderate severity burns conducted in the spring or fall in ponderosa pine and warm-dry mixed conifer forests, and in mountain shrublands. These fires rarely kill canopy trees, but may kill small pine, white fir, or other trees in the understory. Low- to moderate-severity fires would also consume the aboveground portions of shrubs and herbaceous plants in the understory, dead leaves, pine needles, and woody material on the forest floor. Mineral soil may be exposed in some localized areas, but typically, only the top-most, driest layer of litter is consumed by low- to moderate-severity burns, leaving the moister litter and humus intact, especially in areas burned in the spring when soil moisture is high. The thinning of material in the understory creates more open stand conditions. Most of the shrubs and herbaceous understory species in these stands respond well to the increased light, reduced competition, and increased nutrient availability and resprout rapidly from belowground structures. Pine seedlings may also become established in the localized areas where mineral soil is exposed. There could be minor impacts to soils in localized areas such as around large accumulations of woody fuels, but overall, impacts to soils are generally minimal on low- to moderate-severity burns. Invasive plant species may increase in areas where bare soil is exposed. Small, stand-level changes to composition and structure may occur, such as decreasing the amount of white fir, decreasing the density of stands, and increasing young age classes. Over time, if enough areas are burned, these stand-level effects would contribute to composition and structure changes at the landscape level.

Wildfires could potentially occur in any of the terrestrial ecosystems present on the SJNF and TRFO. A vast majority of wildfires stay small, impacting a few acres or less, because they are either quickly suppressed or go out on their own. However, a few wildfires per decade become much larger, impacting thousands of acres or more. This might occur because suppression efforts are not able to keep them small or because it was determined that direct suppression was not the appropriate

management response. Wildfires that burn with low to moderate severity, or mixed severity, would have impacts similar to those discussed above for management ignited fires. Low- to moderate-severity fires are within the HRV for ponderosa pine and warm-dry mixed conifer, and mixed- and low-severity fires are within the HRV for cool-moist mixed conifer. These fires would help restore the composition and structure of these ecosystems to a condition more similar to that seen during the reference period. Impacts from higher-severity stand replacement fires are outside the HRV for ponderosa pine and mixed conifer. However, high-severity, stand-replacement fires that occur at long intervals (200+ years) are within the HRV for spruce-fir, aspen, and pinyon-juniper woodlands. In these terrestrial ecosystems, large, high-severity, stand-replacing fires would change the composition, structure, or pattern of vegetation at the landscape level by creating open-canopied patches or stands within the more closed-canopy matrix of the associated landscape. This helps to maintain or restore landscape-level structural diversity and maintain ecosystem diversity in these terrestrial ecosystems.

High-severity fires can also have different impacts to soils than low- to moderate-severity fires. In areas where high-severity fires consume all ground cover down to mineral soil, there is an increased potential for soil erosion, particularly on steep slopes. High-severity wildfire can also kill soil biota, cause mass movement, and create water-repellant hydrophobic soils that reduce infiltration and increase runoff and soil erosion. Fire decreases the total amount of nutrients available to soil profiles by consumption of carbon at the ground surface. On the other hand, nutrient availability in the soil (including nitrogen) often increases following fire (Pritchett and Fisher 1987; Wan et al. 2001; Wright and Bailey 1982). Invasive plant species may increase in areas where bare soil is exposed by high-severity fires.

Fire suppression activities such as the construction of firelines and the establishment and use of fire camps can also impact terrestrial ecosystems and soils. The bare soil exposed by these activities is more prone to soil erosion and can provide a seedbed for the establishment or spread of invasive plant species. Rehabilitation activities such as seeding, ripping, water barring, and installing erosion-control devices would help mitigate these impacts.

Impacts to federally listed plants species, designated critical habitat, and suitable habitat for these species are possible from wildfires. The known population of Pagosa skyrocket, designated critical habitat, and suitable habitat for this species occur in areas that could be impacted by wildfire. There are no known populations of Knowlton's cactus, Mesa Verde cactus, or Schmoll's milkvetch on SJNF or TRFO lands, but much of the potentially suitable habitat for these species could be impacted by wildfires. The presence of federally listed plant species, critical habitat, or suitable habitat would be taken into account when determining the appropriate suppression action for wildfires.

In addition, one of the four critical habitat units (Eightmile Mesa) and much of the suitable habitat for Pagosa skyrocket is within ponderosa pine and mountain shrublands where management-ignited fires may be used to help restore the composition and structure of these terrestrial ecosystems and reduce fuels in the WUI. Only a very small percentage of designated critical habitat and suitable Pagosa skyrocket habitat would be impacted by management-ignited fires in any given year. These fires would be of low to moderate intensity and low burn severity, which is within the range of light to moderate, or intermittent or discontinuous disturbance, which is one of the primary constituent elements needed to support the life-history processes of Pagosa skyrocket.

Fire management may have impacts to BLM and USFS sensitive plant species that occur in the habitats where fires occur. There is a standard in the LRMP requiring that projects or activities occurring on shale and gypsum soils occupied by special status plant species be designed to maintain the soil characteristics necessary to support and sustain those species. Use of these

standards and other project-specific design criteria and mitigation measures during project-level planning would help minimize impacts to sensitive species at the project level.

The amount of area proposed for management-ignited fire is the same under each alternative, so the impacts to terrestrial ecosystems, special status plant species, and soils would be the same under each alternative. From 1 to 20,000 acres of the SJNF and 1 to 10,000 acres of the TRFO could be impacted by fires managed for resource benefit under Alternative A. Fires managed for resource benefit could impact the terrestrial ecosystems, special status plant species, and soils on an additional 30,000 acres of the SJNF under Alternatives B, C, and D. The amount of area impacted on the TRFO would remain the same under all alternatives.

<u>Timber Harvest and Mechanical Fuels Treatments</u>

Impacts from timber harvest would occur in spruce-fir, aspen, cool-moist mixed conifer, warm-dry mixed conifer, and ponderosa pine forests. Some of the current conditions seen in these terrestrial ecosystems are in part the result of past timber harvest, which has impacted approximately 19% of SJNF lands and a minimal amount of TRFO lands. Under the revised LRMP, approximately 26% to 38% of the SJNF is considered suitable for timber harvest. Timber harvest on these lands would be done for a variety of reasons, which include, but are not limited to, forest restoration, fuels reduction, production of wood products, and maintenance of forest health (e.g., mitigating insect or disease risks).

Impacts from mechanical fuels treatment are most likely to occur in warm-dry mixed conifer forests, ponderosa pine forests, pinyon-juniper woodlands, and mountain shrublands. Chaining and roller chopping for range betterment began in the planning area in the 1970s, and mechanical fuels treatments, including mowing, mastication, and hand thinning, began in the in the late 1990s. Currently, an average of 4,600 acres of the SJNF and 2,300 acres of the TRFO are treated using mechanical fuels treatments each year. Mechanical fuels treatments are used for forest restoration, fuels reduction, wildlife habitat improvement, and range betterment.

Approximately 72% of spruce-fir, 58% of aspen, 76% of cool-moist mixed conifer, 54% of warm-dry mixed conifer, 17% of ponderosa pine, and 13% of pinyon-juniper woodlands are within protected areas, which includes wilderness areas, the Piedra Area, CRAs, and RNAs. Timber harvest and mechanical fuels treatment would not occur within wilderness areas, the Piedra Area, or within upper tier areas of CRAs. However, there could still be a limited amount of tree cutting and temporary road building associated with fuels reduction work and ecosystem restoration in CRAs within 0.5 mile of communities at risk.

It is estimated that approximately 40 to 226 acres of spruce-fir per year on the SJNF and 4 to 24 acres of spruce-fir on TRFO lands would be treated per year using timber harvest methods that emphasize uneven-aged management. Single-tree selection, group selection, and improvement cuts would be the most common harvest methods used. These treatments would provide some diversity in tree size classes (and associated development stages) by creating small openings in the overstory and fostering opportunities for regeneration. This would help make these stands more resilient to insect and disease infestation. However, given the small amount of area that would be impacted each year and the localized nature of the impacts, these treatments would have very little effect on the distribution and abundance of different development stages at the landscape level.

A combination of harvest methods would be used in cool-moist mixed conifer stands. Depending on the alternative, it is estimated that between 40 to 575 acres of cool-moist mixed conifer per year would be treated on the SJNF using timber harvest methods that emphasize uneven-aged

management. Single-tree selection, group selection, and improvement cuts would be the most common methods used. These treatments would reduce stand density and competitive stress, and improve the health and vigor of residual trees due to increased availability of soil moisture and nutrients, as well as subsequent stimulation of growth in these trees. Creating small openings or patches in the overstory would also provide opportunities for regeneration and the development of younger age classes at the stand level. This would result in an increase in size and age class diversity within the stands being treated. In areas that have an aspen component, group selection would encourage aspen regeneration and maintain aspen in these stands.

The most commonly used harvest method in aspen communities is the coppice treatment, which is a regeneration method in which all trees in the previous stand are cut and the majority of the regeneration is from sprouts or root suckers. Depending on the alternative, it is estimated that between 400and 600 acres of aspen would be treated per year across the planning area. Coppice cuts would help stimulate sprouting and would increase the amount of young stands of aspen on the landscape. Sun-loving herbaceous plants would increase initially after these treatments, but shade-tolerant herbaceous species would become dominant as the canopy cover increases.

Both timber harvest and mechanical fuels treatments would occur in warm-dry mixed conifer and ponderosa pine stands through mowing, mastication, restoration harvest treatments, or partial cuts. Depending on the alternative, it is estimated that annually, mechanical fuels treatments would occur on approximately 1,000 to 1,500 acres of ponderosa pine on the SJNF and 500 acres on the TRFO. In addition, either restoration style harvest methods or mechanical restoration treatments would occur on 900 to 1,500 acres of ponderosa pine on the SJNF and 200 acres on the TRFO. Restoration style harvest methods or mechanical restoration treatments would also occur on approximately 500 acres of warm-dry mixed conifer on the SJNF and 0 to 40 acres of warm-dry mixed conifer on the TRFO. Restoration style treatments are a form of partial cut where post-harvest residual density is partially or closely tied to HRV. Another 400 to 500 acres of ponderosa pine and 225 to 250 acres of warm-dry mixed conifer would be treated using partial cuts. Restoration treatments would reduce stand densities, alter stand structure, and change relative species composition to be more similar to that seen during the reference period. Standards and guidelines in the LRMP regarding prioritization of old growth recruitment areas would help minimize reductions in old growth due to timber harvest and mechanical fuels treatments in ponderosa pine and mixed conifer terrestrial ecosystems. Reducing stand density and opening up the forest canopy would generally stimulate the growth of grasses and other herbaceous species in the understory of these stands. Mechanical fuels treatments would also reduce stand density and open up the forest canopy. However, the response of understory species may be reduced where chips cover the ground. Where the quantity of chips is reduced through burning or natural decomposition, this effect would be reduced. Mechanical fuels treatments would also reduce the amount of understory shrubs and small trees, which would reduce the risk of crown fire, thus reducing the risk of fire behavior that is outside that expected under HRV for pine and warm-dry mixed conifer.

The combination of timber harvest and mechanical fuels treatment would help to restore the composition and structure of ponderosa pine and warm-dry mixed conifer ecosystems at the stand level. These stand-level effects, combined with the use of management-ignited fires and the appropriate management of naturally ignited wildfires, would contribute to effects on the landscape level. The combination of all these treatments would help to maintain or restore the heterogeneous structure and pattern of ponderosa pine and warm-dry mixed conifer forests that were present on the SJNF and TRFO during the reference period.

In pinyon-juniper woodlands, it is estimated that mechanical fuels treatments would occur on approximately 500 to 1,000 acres on the SJNF and 500 acres on the TRFO per year. Mechanical fuels treatments in pinyon-juniper woodlands are primarily intended to reduce hazardous fuels in the WUI. These treatments are also used to maintain sage flats by removing encroaching pinyon-juniper and to maintain old chainings for wildlife habitat. These treatments reduce the density of stands, thus reducing the risk of sustained crown fire. Standards and guidelines in the LRMP regarding prioritization of old growth recruitment areas would help minimize impacts to pinyon-juniper old growth due to timber harvest and mechanical fuels treatments.

Mechanical fuels treatments would occur on approximately 2,000 acres of mountain shrubland on the SJNF and 500 acres on the TRFO per year. Mowing or mastication would cause many of the species present in these areas to resprout rapidly, creating young age classes of mountain shrublands. This would change the structure or pattern of the vegetation at the landscape level by creating young age classes within the relatively mature mountain shrublands currently present across most of the planning area.

Roads associated with timber harvest and mechanical fuels treatment may cause fragmentation on the landscapes impacted by these treatments (Reed et al. 1996; Tinker et al. 1998). These impacts would occur on a very small percent of the planning area and most new roads would be closed and revegetated after their use.

Impacts to soils from timber harvest activities and mechanical fuels treatments are dependent on many factors, including, but not limited to, what type of equipment is used, how many times equipment passes over the same piece of ground, time of year activities occur, and soil moisture content at time of impact. A majority of adverse impacts to soils would occur on landings and along skid trails where activities are often concentrated. Given the application of standards and guidelines, soil compaction and associated erosion should be short-lived and localized, and would affect a relatively small number of acres. The application of soil-specific mitigation measures and design criteria found in the Rocky Mountain Region Soil and Water Conservation Practices Handbook, FSH 2509.25 (for the USFS), would also help minimize impacts to soils. Soil productivity would not be adversely affected since most of the soils on which timber harvest and mechanical fuels treatment activities occur are inherently fertile and contain nutrient-rich and organic matter-rich surface horizons, leaves/needles, branches, and bark (Bockheim et al. 1983; Powers et al. 1990). Since these activities would not cause detrimental soil erosion or compaction and would not adversely affect soil fertility, the soil productivity of the affected terrestrial ecosystems would be maintained. Timber harvest and mechanical fuels treatments can also contribute to the introduction and spread of invasive plant species by causing soil disturbance. These impacts would be mitigated by post-project treatments.

There have been no impacts from timber harvest or mechanical fuels reduction projects to the known population of Pagosa skyrocket on the TRFO, and given the location of this population, none are expected in the future. There are no other known populations of federally listed plant species on the SJNF and TRFO; however, potentially suitable habitat for Knowlton’s cactus and Schmoll’s milkvetch could be impacted by mechanical fuels treatments. In addition, much of the suitable habitat, and one of the four critical habitat units (Eightmile Mesa) for Pagosa skyrocket could be impacted by restoration style timber harvest or mechanical fuels treatment. These activities may be used to help restore the composition and structure of these terrestrial ecosystems and reduce fuels in the WUI. Impacts to critical habitat and suitable habitat would be minimized through the application of various standards and guidelines designed to 1) protect the primary constituent elements needed to sustain the life history processes of federally listed species, 2) minimize long-term impacts to suitable habitat

for federally listed plant species, 3) minimize impacts to Mancos Shale soil, 4) provide habitat for pollinators by retaining adequate slash, and 5) prevent establishment of non-native plant species by avoiding the use of non-native and invasive exotic plant species during revegetation projects.

Timber harvest and mechanical fuels treatments may have impacts to BLM and USFS sensitive plant species that occur in the habitats where treatments may occur. There is a standard in the LRMP requiring that projects or activities occurring on shale and gypsum soils occupied by special status plant species be designed to maintain the soil characteristics necessary to support and sustain those special status plant species. Use of these standards and guidelines and other project-specific design criteria and mitigation measures during project-level planning would help minimize impacts to sensitive species at the project level.

Timber harvest under Alternative D would impact the vegetation and soils on approximately 3,750 acres of per year, followed by Alternative B at 2,675 acres and Alternative A at 2,650 acres. Alternative C would impact the vegetation and soils on the fewest acres per year (2,165). While Alternatives A, B, and C would impact the vegetation and soils on fewer acres, there would also be less opportunity under these alternatives to use mechanical fuels treatments for ecosystem restoration purposes than under Alternative D.

Fuels treatments (e.g., mechanical restoration and mastication) under Alternative D would impact the vegetation and soils on approximately 7,700 acres per year, while Alternatives A, B, and C would each impact approximately 6,700 acres per year. Alternatives A, B, and C would impact the vegetation and soils on fewer acres, but there would be less opportunity under these alternatives to use mechanical fuels treatments for ecosystem restoration purposes than under Alternative D.

Oil and Gas Development

Oil and gas development activities (including the construction of well pads, compressor stations, pipelines, and roads) would occur primarily in lower-elevation terrestrial ecosystems, including ponderosa pine, pinyon-juniper, mountain shrublands, sagebrush shrublands, semi-desert shrublands, and semi-desert grasslands. The areas most likely to see oil and gas development activities include the NSJB area, San Juan Sag, GSGP, and PLAA. A majority of the new oil and gas development on the SJNF and TRFO would occur within the PLAA.

Areas that have been withdrawn from leasing or are administratively unavailable for leasing would not be impacted by oil and gas development. Currently, there are approximately 509,954 acres on the SJNF that have been withdrawn from leasing, and another 16,357 acres on the SJNF and 62,437 acres on the TRFO that is administratively unavailable for leasing. In addition, the opportunity for oil and gas development within the roughly 566,100 acres of CRAs is limited because NSO is allowed in CRAs unless there is a prior existing right under lease.

During the construction phase of oil and gas development, well pads and access roads would be cleared of all trees, shrubs, and herbaceous vegetation, and topsoil would be removed and stockpiled for later use. If a well is unsuccessful, disturbed areas would be reclaimed, usually within a 1- to 2-year period. If a well is successful, interim reclamation would be conducted, but the well pads and access roads would remain clear of vegetation for the life of the well (typically 20–30 years). When oil and gas extraction is complete, well pads and roads constructed for oil and gas development are reclaimed to the standards required by the USFS or BLM. Reclamation typically involves contouring, tilling compacted soils, seeding, and mulching.

Impacts to terrestrial ecosystems, special status plant species, and soils from oil and gas development would vary, depending on whether the activity is being conducted under an existing lease or a new lease. For existing leases, standard lease terms require operators to minimize adverse impacts to biological resources and allow the BLM and USFS to mitigate potential resource effects by moving a proposed drill site up to 200 meters if determined necessary to minimize adverse impacts. COAs, which are based on the requirements set forth in the LRMP, may also be used for the development of existing leases. Stipulations can also be applied to existing leases if warranted. For new leases, in addition to the standard lease terms and COAs, various special lease stipulations can also be applied if additional restrictions are required to protect environmental resources. The special lease stipulations that apply to terrestrial ecosystems, special status plant species, and soils include NSO and CSU. Which special lease stipulations may be applied to a new oil and gas lease varies by alternative and is shown in Table 3.2.3. Application of standard lease terms, COAs, and special lease stipulations would help minimize impacts to resources. However, the construction, operation, and reclamation of well pads and roads would still result in localized impacts to the vegetation and soils present in areas that are developed.

In the localized areas disturbed by oil and gas development, the abundance of desirable native plant species would be reduced for the life of the well. Desirable native species can be used during reclamation activities to help restore these species to the affected terrestrial ecosystems. However, it can take a long period of time for native species to re-establish fully on a site where vegetation has been completely removed, particularly on low-elevation sites with little topsoil and unreliable levels of precipitation. There is also a lack of commercially available native seed associated with both low-elevation and alpine terrestrial ecosystems, which would make reclaiming the site with the appropriate native plant species all the more challenging. One of the objectives of the LRMP is to secure a reliable source of local seed stock for 16 or more native grass, forb, and shrub species for use in revegetation and restoration within the next 15 years, which should provide more options for reclamation. Clearing vegetation and exposing bare ground can also lead to the establishment of new populations of invasive plant species or the expansion of existing populations. Conducting interim reclamation on successful wells and imposing COAs during the oil and gas permitting process that require treatment of existing or new weed populations can help mitigate this impact.

When well pads and access roads are located in ponderosa pine and pinyon-juniper stands, small, localized changes to stand structure may occur when trees are removed. While this would be a minor impact in some areas, the removal of large, old trees in old growth ponderosa pine and pinyon-juniper stands would exacerbate the current trend toward a lack of old growth in these forested types. In areas already under lease, but not yet developed, standard lease stipulations can be used to move the location of a well pad or access road prior to development to help prevent or minimize impacts to old growth ponderosa pine and pinyon-juniper stands. The guideline in the LRMP stating that old growth ponderosa pine and pinyon-juniper should be managed for their old growth values can also be used to condition the approval of development on existing leases. In new lease areas, special lease stipulations may also be applied to prevent or minimize impacts to old growth ponderosa pine and pinyon-juniper. Alternative C offers the highest level of protection because it is the only alternative that allows the application of an NSO stipulation in old growth ponderosa pine and pinyon-juniper. Both Alternatives B and D allow for a CSU stipulation to be applied to new leases. Under Alternative A, only standard lease terms can be applied.

Depending on the density and spacing of well pads and roads, oil and gas development could also cause fragmentation of those landscapes most impacted by oil and gas development. Well pads and roads create unvegetated patches and linear corridors within the relatively closed-canopy matrices of

these landscapes. Fragmentation would be most pronounced in the areas that receive the most development, including the GSGP and PLAA.

The known population of Pagosa skyrocket and the designated critical habitat for this species are not under lease. However, some of the suitable habitat for Pagosa skyrocket is in areas that are currently under lease. There are no known populations of Knowlton's cactus, Mesa Verde cactus, or Schmoll's milkvetch on SJNF or TRFO lands. Almost none of the potentially suitable habitat for these species is currently under lease. In areas already under lease, but not yet developed, standard lease terms can be used to move the location of a well or access road prior to development to help prevent or minimize impacts to federally listed plant species and their suitable habitat. There is also a guideline in the LRMP that states that activities should be managed to minimize long-term impacts to the suitable habitat of federally listed plant species. These guidelines can be used to condition the approval of development on existing leases. In new lease areas, impacts to federally listed plant species and designated critical habitat would be prevented by application of the NSO stipulation in areas occupied by federally listed plant species and within a 650-foot buffer around those lands. The NSO stipulation for federally listed species would be applied under each alternative. With the application of this NSO stipulation, there would be no effect to federally listed plants species or designated critical habitat from oil and gas development activities. Generally, stipulations protecting federally listed plants species, designated critical habitat, and suitable habitat for federally listed plants species would allow the agency to mitigate impacts to these resources.

Impacts to USFS and BLM sensitive plant species and suitable habitat for these species are possible during oil and gas development. Many known populations of USFS and BLM sensitive plant species and suitable habitat for these species occur in areas that are currently under lease. In areas already under lease, but not yet developed, standard lease terms can be used to move the location of a well or access road prior to development to help prevent or minimize impacts to USFS and BLM sensitive plant species and their suitable habitat. The standard in the LRMP requiring that activities in shale and gypsum soils occupied by special status plant species be designed to maintain the soil characteristics necessary to support and sustain those special status plant species can also be used to condition the approval of development on existing leases. In new lease areas, impacts to USFS and BLM sensitive plant species and suitable habitat for these species would be minimized by the application of standard lease terms or prevented by the application of special lease stipulations, depending on the alternative. Alternative C offers the highest level of protection to sensitive plant species because it is the only alternative that allows the application of an NSO stipulation on lands occupied by sensitive species and within a 325-foot buffer around those lands. Alternative B allows for a CSU stipulation to be applied to new leases. Under Alternatives A and D, only standard lease terms can be applied.

Possible impacts to soils from oil and gas development include compaction and increased erosion from pad sites and roads. Where wells are unsuccessful and reclamation is completed within 1 to 2 years, these impacts would be relatively short term. If a well is successful, interim reclamation would be conducted, but there would still be increased levels of soil compaction and increased potential for erosion on well pads and along access roads for the life of the well (typically 20–30 years). In areas already under lease, but not yet developed, the application of soil-specific mitigation measures and design criteria found in the Rocky Mountain Region Soil and Water Conservation Practices Handbook, FSH 2509.25 (for the USFS), and in the BLM's Water Quality Manual would help minimize impacts to soil from oil and gas development activities. Standard lease stipulations can also be used to move the location of a well prior to development to help minimize impacts to soils. In new lease areas, special lease stipulations may also be applied to minimize impacts to soils. On lands prone to mass movement or on lands with slopes greater than 35%, Alternatives A, B, and C provide the most

protection by allowing an NSO stipulation to be applied to these lands. Under Alternative D, a CSU leasing stipulation would be applied to these lands. For lands with slopes of 25% to 35% and shale soils, lands with gypsum soils, and lands with biological soil crusts, Alternative C provides the most protection by allowing an NSO stipulation to be applied to these lands. Alternative B offers the second most protection to these lands by allowing a CSU stipulation to be applied. Under Alternatives A and D, only standard lease terms can be applied to these lands. Overall, Alternative C offers the most protection to soil resources, then Alternative B, then Alternative A. Alternative D offers the least amount of protection to soil resources.

Another potential impact to soils from oil and gas development is the increased chance of contamination from spills. The use of closed loop pitless drilling systems where technically feasible, which is included as a standard in the LRMP, would substantially decrease the risk of soil contamination. There are also several guidelines in the LRMP that would decrease the risk of soil contamination, including one that states that non-toxic fluid, additives, and other materials should be used for well drilling. Another guideline states that exploration and production waste should be disposed of using BMPs that meet state regulations and specific BLM or USFS requirements, and should be disposed of in such a manner as to not inhibit reclamation success of the site. There are also guidelines stating that centralized liquid gathering systems should be used for the delivery and gathering of fluids, and that water use and disposal management plans should be included in plans of development for fluid and solid minerals projects. These standards and guidelines contained in the LRMP can be used to condition the approval of development on both existing and new leases to help mitigate the potential for soil contamination from spills.

Overall, oil and gas development under the No Leasing Alternative would have the least amount of impact on terrestrial ecosystems, special status plant species, and soils, since impacts would only occur in areas that are already under lease. Areas not currently under lease would not be impacted under the No Leasing Alternative. In regards to Alternatives A through D, Alternative C would have the least amount of impact on terrestrial ecosystems, special status plant species, and soils. Alternative C has the highest number of acres that are withdrawn from leasing or are administratively unavailable for leasing (Table 3.2.2), and the special leasing stipulations available under this alternative offer the highest level of resource protection available to terrestrial ecosystems, special status plant species, and soils (Table 3.2.3). Alternative B offers the second highest number of acres withdrawn or unavailable for leasing and the second highest level of protection to terrestrial ecosystems, special status plant species, and soils from special leasing stipulations; Alternative A offers the third. Alternative D has the fewest number of acres that are withdrawn from leasing or are administratively unavailable for leasing and the lowest level of protection from special leasing stipulations.

Table 3.2.2:Acres of Area Withdrawn from Leasing or Administratively Not Available for Leasing

Jurisdiction	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
USFS					
Acres withdrawn from leasing	509,954	509,954	509,954	509,954	509,954
Acres administratively not available for leasing	16,357	73,636	644,113	14,896	1,353,448
BLM					
Acres withdrawn from leasing	0	0	0	0	0
Acres administratively not available for leasing	62,437	62,570	161,637	56,916	503,466

Table 3.2.3: Special Leasing Stipulations Related to Terrestrial Ecosystems, Special Status Plant Species, and Soils

Stipulation	Alternative A	Alternative B	Alternative C	Alternative D
Old growth forests and woodlands	SLT	CSU	NSO	CSU
Threatened, endangered, proposed, and candidate Plant Species	NSO	NSO	NSO	NSO
Colorado BLM State Director's sensitive species and Region 2 Regional Forester's sensitive species	SLT	CSU	NSO	SLT
SBAs	CSU	NSO	NSO	CSU
Lands with slopes greater than 35%	NSO	NSO	NSO	CSU
Lands with slopes of 25% to 35% and shale soils	SLT	CSU	NSO	SLT
Lands prone to mass movement	NSO	NSO	NSO	CSU
Lands with gypsum soils	SLT	CSU	NSO	SLT
Lands with biological soil crusts	SLT	CSU	NSO	SLT
SLT = Standard lease terms.				

Solid Minerals Development

The most common types of solid minerals development within the planning area include gravel operations, landscape rock, hard-rock mining, and uranium mining. Most major solid minerals development activity is currently restricted to lower-elevation terrestrial ecosystems on TRFO lands in the Slick Rock area near Dove Creek. Some small-scale activity is also possible in the alpine terrestrial ecosystems on TRFO lands around Silverton and in a variety of terrestrial ecosystems on the SJNF around the Rico and La Plata areas. Federal authority over mining activities allows for the setting of terms and conditions in operating plans in order to minimize impacts to public lands.

Currently, there are 502,502 acres on the SJNF and 3,557 acres on the TRFO that have been withdrawn from leasing. In addition, on the SJNF, the opportunity for new solid minerals development within the roughly 566,100 acres of CRAs is somewhat limited because new road construction is prohibited, unless there is a prior existing right.

New mining operations for locatable minerals are expected to be small and limited in quantity. Increases in mining activity are not anticipated; however, to a certain extent, this cannot be predicted. Environmental impacts related to solid minerals development would vary depending on what type of extraction method is used. Solid minerals are developed by surface mining (collecting, quarrying, and open pit mining), subsurface mining (underground mining), or solution mining. Solution mining shares many similarities with the type of fluid mineral extraction typically seen in oil and gas development. Therefore, the impacts to terrestrial ecosystems, special status plant species, and soils from solution mining would be similar to those previously discussed under the oil and gas development section.

Most impacts to terrestrial ecosystems, special status plant species, and soils from surface or subsurface mining would be concentrated around the mine or mill facility and along access roads. Potential impacts to vegetation in these areas include the clearing, trampling, uprooting, or killing of vegetation within the impacted area. In the localized areas disturbed by surface or subsurface mining, the abundance of desirable native plant species would be reduced for the life of the mine. Desirable native species can be used during reclamation activities to attempt to restore these species to the affected terrestrial ecosystems. However, it can take a long period of time for native species to re-establish fully on a site where vegetation has been completely removed, particularly on low-elevation sites and alpine areas, both of which often have little topsoil. There is also a lack of commercially

available native seed associated with both low-elevation and alpine terrestrial ecosystems, which would make reclaiming the site with the appropriate native plant species more challenging. One of the objectives of the LRMP is to secure a reliable source of local seed stock for 16 or more native grass, forb, and shrub species for use in revegetation and restoration within the next 15 years, which should provide more options for reclamation.

Clearing existing vegetation and exposing bare ground at mine and mill sites and along access roads can also lead to the establishment of new populations of invasive plant species or the expansion of existing populations. Conducting interim reclamation and including specific environmental protection measures in operating plans that require treatment of existing or new weed populations can help mitigate this impact.

Impacts to federally listed plants species, designated critical habitat, and suitable habitat for federally listed plants species are possible during solid minerals development. The known population and the designated critical habitat for Pagosa skyrocket, and the suitable habitat for Knowlton’s cactus, Mesa Verde cactus, or Schmoll’s milkvetch, are within areas of low potential for solid minerals development. On lands occupied by Pagosa skyrocket, or on lands designated as critical habitat for Pagosa skyrocket, there is a standard in the LRMP requiring that activities in occupied habitat or in designated critical habitat be designed and conducted in a manner that preserves the primary constituent elements needed to sustain the life history processes of this species. There is also a guideline in the LRMP that states that activities should be managed to minimize long-term impacts to the suitable habitat of federally listed plant species. Including specific environmental protection measures in operating plans based on these guidelines would help prevent impacts to federally listed plant species and designated critical habitat, and would minimize potential impacts to the suitable habitat of federally listed plant species.

For BLM and USFS sensitive plant species, there are standards requiring that projects or activities occurring in fens, wetlands, and hanging gardens occupied by special status plant species, and on shale and gypsum soils occupied by special status plant species, be designed to maintain the soil characteristics necessary to support and sustain those special status plant species. These standards can be used in operating plans to help minimize potential impacts to special status plant species from solid minerals development.

Clearing vegetation and exposing bare ground could also result in localized soil erosion at mines and mill sites and along access roads. The use of heavy equipment around mine and mill sites may also result in soil compaction. The application of soil-specific mitigation measures and design criteria found in the Rocky Mountain Region Soil and Water Conservation Practices Handbook, FSH 2509.25 (for the USFS), and the BLM’s Water Quality Manual would help minimize impacts to soil from solid minerals development activities. Another potential impact to soils is the increased chance of contamination from spills. There are several guidelines in the LRMP that would decrease the risk of soil contamination, including one that states that that exploration and production waste should be disposed of using BMPs that meet state regulations and specific BLM or USFS requirements, and should be disposed of in such a manner as to not inhibit reclamation success of the site. There is also a guideline stating that water use and disposal management plans should be included in the operating plans for solid minerals projects. These BMPs and guidelines can be used in operating plans to help mitigate the potential for soil contamination.

The number of acres available for solid minerals development varies by nearly 600,000 acres between alternatives. Alternative C has the fewest number of acres open to locatable mineral development and the highest number of acres proposed for withdrawal, and thus would have the least amount of potential impact on terrestrial ecosystems, special status plant species, and soils.

Alternative B has more acres available for mineral development and fewer acres proposed for withdrawal as compared to Alternative C. Alternatives A and D have the most acres available for locatable mineral development and do not propose the withdrawal of any additional areas from mineral development, and would therefore have the most potential to impact terrestrial ecosystems, special status plant species, and soils. The number of acres currently withdrawn from possible solid minerals development is the same for each alternative. See Table 3.2.4 for a summary of area available for solid minerals development by alternative.

Table 3.2.4: Acres of Open to Locatable Mineral Development

Jurisdiction	Alternative A	Alternative B	Alternative C	Alternative D
USFS				
Open to locatable mineral development	1,279,087	1,220,604	751,447	1,279,087
Withdrawn	502,502	502,502	502,502	502,502
Petition to withdraw	0	58,482	527,640	0
BLM				
Open to locatable mineral development	724,638	711,983	656,579	724,638
Withdrawn	3,557	3,557	3,557	3,557
Petition to withdraw	0	12,655	68,059	0

Livestock Grazing

Areas considered suitable for livestock grazing include those areas that are physically capable of being grazed and areas that are appropriate for grazing (active, vacant, or forage reserve allotments). Closed allotments are not considered suitable for livestock grazing. Currently, approximately 48% of the SJNF and 62% of the TRFO are considered suitable for livestock grazing.

Past livestock grazing has had a significant impact on the current conditions seen in the many of the terrestrial ecosystems on the SJNF and TRFO, particularly mountain grasslands, semi-desert shrublands, semi-desert grasslands, sagebrush shrublands, and pinyon-juniper woodlands. Beginning in the late 1800s, these easily accessible, low-elevation areas often received heavy, year-round grazing by cattle. Over the years, grazing has become better regulated and the numbers of animals grazing on public lands has been significantly reduced. However, the legacy of past heavy grazing is still seen in many of the low-elevation terrestrial ecosystems. Currently, many mountain grasslands that were heavily grazed in the past show reduced species diversity and the distribution of native grasses has been significantly altered. In these areas, dominant bunchgrasses such as Arizona fescue have been replaced by exotic species (including Kentucky bluegrass, dandelion [*Taraxacum* sp.], and noxious weeds) and native increasers (such as yarrow [*Achillea millefolium*], cinquefoil [*Potentilla* sp.], mulesears [*Wyethia* sp.], sneezeweed [*Helenium autumnale*], and annual forbs). Heavy livestock grazing in the past also caused high amounts of bare soil, reduced amounts of litter, and increased soil erosion and compaction problems, which has reduced soil productivity on some sites (Romme et al. 2009). Species diversity and distribution was also altered in pinyon-juniper woodlands, sagebrush shrublands, semi-desert shrublands, and semi-desert grasslands. Heavy grazing also significantly impacted the distribution of biological soil crusts in these terrestrial ecosystems and caused a loss of soil productivity and stability. In many cases, this has had a long-term impact on site potential in these low-elevation terrestrial ecosystems.

Early sheep grazing on the SJNF and TRFO also had impacts on the current conditions seen in some alpine areas. Historic records indicate that during the peak of sheep use between 1910 and 1930, there were areas of overstocking and heavy use that were causing negative impacts to vegetation. Some soil erosion was also occurring along heavily used stock trails. The impacts of historic sheep use on vegetation and evidence of erosion on heavily used trailing routes is still visible in some areas. In areas that are no longer used for sheep grazing, these impacts are becoming less and less obvious.

There has been a significant reduction in the numbers of cattle and sheep that graze on the SJNF and TRFO since the early 1900s. For example, in the 1930s, approximately 216,684 sheep and 41,968 cattle were permitted on the SJNF. In 2012, approximately 14,330 sheep and 23,412 cattle were permitted. In addition, there are also fewer acres available for livestock grazing than in the past. Currently, about half of the SJNF and approximately two-thirds of the TRFO are considered suitable for livestock grazing. As with past grazing, most impacts from current grazing would occur within mountain grasslands, semi-desert shrublands, semi-desert grasslands, sagebrush shrublands, and pinyon-juniper woodlands. Impacts from current livestock grazing in suitable areas are dependent on many factors, including timing, frequency, duration, and intensity of the grazing. Impacts can include trampling of plants and direct removal of plant material through grazing. This can decrease plant vigor and root reserves and could result in mortality to plants and loss of ground cover. Grazing can also impact the litter layer, resulting in a loss of ground cover, decreasing soil organic matter, soil compaction, and increasing bare soil. This can, in turn, reduce infiltration, increase runoff, and increase soil erosion. Grazing can also introduce or spread invasive plant species that compete with native plants for space, water, and nutrients (Balph and Malechek 1985; Dadkhah and Gifford 1981; Orr 1975).

Livestock are managed, and undesirable impacts mitigated, through the Allotment Management Plan (AMP). The AMP identifies appropriate seasons of use, allowable forage use guidelines, stocking rates, range improvements necessary to move towards desired conditions, and coordination with other resource needs. Annual operating instructions implement the AMP on an annual basis. The annual operating instructions provide annual pasture rotations, season of use, and allowable use guidelines. Implementation of required management practices and long-term impacts related to grazing are monitored. As necessary, adjustments are made in order to ensure compliance with the terms and conditions of grazing permits, the AMP, and the annual operating instructions. Standards and guidelines in the LRMP would also help to minimize adverse impacts from grazing. This includes the standard requiring that utilization standards be developed for key herbaceous and woody plant species at the project level and guidelines to phase out season-long grazing, design grazing systems to provide periodic rest to forage species during the critical growing season, and move livestock when utilization guidelines are met or exceeded.

Livestock grazing is not currently permitted on TRFO lands occupied by Pagosa skyrocket, so there would be no direct effects to federally listed plant species from livestock grazing. However, potentially suitable habitat for Knowlton's cactus, Mesa Verde cactus, and Schmoll's milkvetch could be impacted by livestock grazing. In addition, much of the suitable habitat for Pagosa skyrocket and both Pagosa skyrocket critical habitat units that occur on the SJNF are part of active grazing allotments. Impacts to suitable habitat for federally listed plant species and critical habitat for Pagosa skyrocket would be minimized through the application of various standards and guidelines designed to 1) protect the primary constituent elements needed to sustain the life history processes of federally listed species, 2) minimize long-term impacts to suitable habitat for federally listed plant species, 3) minimize impacts to Mancos Shale and gypsum soil, and 4) prevent establishment of non-native plant

species by avoiding the use of non-native and invasive exotic plant species during revegetation projects.

Livestock grazing may have impacts to BLM and FS sensitive plant species that occur in the habitats where grazing may occur. There is a standard in the LRMP requiring that projects or activities occurring in fens, wetlands, or hanging gardens occupied by special status plant species, or on shale and gypsum soils occupied by special status plant species, be designed to maintain the soil characteristics necessary to support and sustain those special status plant species. Use of these standards and guidelines and other project-specific design criteria and mitigation measures during project level planning would help minimize impacts to sensitive species at the project level.

Proposed stocking rates and the amount of area available for permitted livestock grazing varies between alternatives. Alternative D has the potential to impact the highest number of acres and proposes the highest cattle stocking rates, and therefore has the most potential to impact terrestrial ecosystems. Alternative B has the next highest potential to impact terrestrial ecosystems, followed by A then C due to incrementally lower numbers of permitted cattle and fewer acres considered suitable for grazing.

Recreation

A variety of recreation activities have the potential to impact terrestrial ecosystems, special status plant species, and soils on the SJNF and TRFO, including, but not limited to, camping, hiking, mountain biking, horseback riding, and motorized recreation. Recreation use is widespread and would occur to some extent in all of the terrestrial ecosystems on the SJNF and TRFO, but impacts are typically confined to localized areas such as designated trails, frequently used campsites, or developed recreation facilities such as campsites or trailheads.

Recreation use can cause direct impacts to the vegetation and soils within terrestrial ecosystems through the trampling, uprooting, or killing of vegetation and the displacement of ground cover. Recreation use is also one of the many factors that can contribute to the establishment and spread of noxious weeds. This can occur when people, pets, recreation stock, or recreational vehicles spread weed seeds along trails or cause disturbance off-trail that creates bare ground and seed beds favorable to the establishment of weeds. Recreation use can also contribute to soil compaction along highly traveled routes. The loss of ground cover can expose bare soil and cause localized soil erosion. The extent of those impacts would depend on the vegetation type, plant growth form (graminoids are more resistant to damage compared to trees, shrubs, and forbs), slope, soil type, season, and weather conditions (Hill and Pickering 2009).

There are currently no recreation-related impacts to the population of Pagosa skyrocket on TRFO lands, and given the location of this population, none are expected in the future. However, the designated critical habitat for Pagosa skyrocket and the suitable habitat for Knowlton’s cactus, Mesa Verde cactus, or Schmoll’s milkvetch are within areas of low potential for recreation use. Within the designated critical habitat and suitable habitat for Pagosa skyrocket, some dispersed recreation use such as hiking, mountain biking, and horseback riding does occur. There is no motorized recreation use within the designated critical habitat for Pagosa skyrocket. All motorized recreation within suitable habitat for Pagosa skyrocket is confined to designated routes. The potentially suitable habitat for Knowlton’s cactus, Mesa Verde cactus, and Schmoll’s milkvetch currently receive low levels of dispersed recreation use. On lands occupied by Pagosa skyrocket, or on lands designated as critical habitat for Pagosa skyrocket, there is a standard in the LRMP that states that activities must be designed and conducted in a manner that preserves the primary constituent elements needed to sustain the life history processes of this species. There is also a guideline in the LRMP that states

that activities should be managed to minimize long-term impacts to the suitable habitat of federally listed plant species. Use of these standards and guidelines during project-level planning would help minimize future impacts to Pagosa skyrocket and its designated critical habitat. These standards and guidelines would also help minimize potential impacts to the suitable habitat of both species, but some impacts from dispersed recreation are still possible.

Recreation impacts to BLM and USFS sensitive plant species are also possible. There are standards in the LRMP requiring that projects or activities occurring in fens, wetlands, and hanging gardens occupied by special status plant species, and on shale and gypsum soils occupied by special status plant species, be designed to maintain the soil characteristics necessary to support and sustain those special status plant species. Use of these standards and guidelines during project-level planning would help minimize impacts to sensitive species during project level planning, but impacts from dispersed recreation are still possible.

While the actual direct impacts from different types of recreation use are similar for all alternatives, the amount of area potentially impacted varies by alternative, primarily because of differences in the number acres that would be designated as suitable for motorized use. Alternative A has the most amount of area designated as suitable for motorized recreation and is the only alternative that allows motorized travel off of designated routes, which therefore has the potential to impact the terrestrial ecosystems, special status plant species, and soils on highest number of acres. Alternative D has the second highest amount of area designated as suitable for motorized recreation, followed by Alternative B. Alternative C has the fewest number of acres designated as suitable for motorized recreation and therefore has the potential to impact the terrestrial ecosystems, special status plant species, and soils on the fewest number of acres.

Cumulative Impacts

Past management activities (including fire management, timber harvest, mechanical fuels treatments, livestock grazing, oil and gas development, solid minerals development, and recreation) on federal and non-federal lands within the planning area caused impacts to terrestrial ecosystems, special status plant species, and soils, as described above. Many of the impacts associated with those activities (soils disturbances) have recovered due to restoration efforts and natural processes. Many other adverse impacts (particularly those associated with fire management and livestock grazing) are still evident on the SJNF and TRFO and would remain evident over the next 15 years. Project designs and the proper implementation of mitigation measures, COAs, stipulations, standards, and guidelines served to protect the composition, structure, and function of terrestrial ecosystems, special status plant species, and soils on most past projects.

Additional impacts to terrestrial ecosystems, special status plant species, and soils (as described above) on federal and non-federal lands within the planning area would occur from the implementation of management activities in the LRMP and from foreseeable future management activities beyond the 15-year life of the LRMP. Those impacts are anticipated to be localized and would not adversely affect the ecological integrity of most of the affected terrestrial ecosystems and would not affect the ability of most terrestrial ecosystems and soils to achieve their desired conditions in the LRMP.

The cumulative impacts of past, present and foreseeable future management activities on federal and non-federal lands within the planning area could cause impacts to terrestrial ecosystems, special status plant species, and soils, as described above, on a small percent of the planning area. Those impacts would not adversely affect the ecological integrity of most of the affected terrestrial ecosystems and soils, would likely not change the diversity of terrestrial ecosystems, would not

adversely affect the diversity or viability of special status plant species, and would not likely affect the ability of most terrestrial ecosystems and soils to achieve their desired conditions in the LRMP. Project designs, the implementation of standards, guidelines, and stipulations in the LRMP, and the implementation of mitigation measures would minimize adverse cumulative impacts to terrestrial ecosystems, special status plant species, and soils on federal lands.

3.3 Terrestrial Wildlife

3.3.1 Introduction

The conservation of terrestrial wildlife species is integral to the maintenance of viable plant and animal populations and biological diversity (Finch and Ruggiero 1993). Lands administered by the SJNF and TRFO have long served an important role in supporting a variety of native and desired non-native wildlife species that are critical to the needs and values of the human population.

The federal land management agencies and the state wildlife management agencies share legal co-trustee responsibility for the protection and management of wildlife species. Therefore, the SJNF and TRFO would continue to work closely and cooperatively with CPW in the conservation and management of terrestrial wildlife resources, including the habitats on which they depend, on the SJNF and TRFO in order to meet the needs of a growing human population that places increasing demands on resources, and sometimes, competing values, that ultimately impact the wildlife resource.

This chapter describes the existing conditions and trends for the native and desired non-native terrestrial wildlife within the planning area, as well as the anticipated environmental impacts related to implementing the alternatives (see Chapter 2).

Legal and Administrative Framework

Laws

- **The National Forest Management Act of 1976:** This act substantially amends the Forest and Rangeland Renewable Resources Planning Act of 1974. This act strengthens the references pertaining to suitability and compatibility of land areas; stresses the maintenance of productivity, as well as the need to protect and improve the quality, of soil and water resources; and seeks to avoid the permanent impairment of the productive capability of the land.
- **The Multiple-Use Sustained-Yield Act of 1960:** Under this act, “National forests are established and shall be used for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.” The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple uses and sustained yield, without impairment of the productivity of the land.
- **The Federal Land Policy and Management Act of October 21, 1976:** This act declares that “the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values.” It also states that “Terms and conditions must minimize damage to scenic and aesthetic values and fish and wildlife habitat and otherwise protect the environment.”
- **The Endangered Species Act of 1973:** This act was designed to protect critically imperiled species from extinction from “the consequences of economic growth and development untempered by adequate concern and conservation.” Under the act, all federal agencies are

required to undertake programs for the conservation of endangered and threatened species, and are prohibited from authorizing, funding, or carrying out any action that would jeopardize a listed species or destroy or modify its “critical habitat.”

- **Bald Eagle Protection Act of June 8, 1940, as amended:** This act provides for the protection of bald eagles through the regulation of take on the species.
- **Sikes Act of September 16, 1960:** The act provides for carrying out wildlife and fish conservation programs on federal lands, including authority for cooperative state-federal plans and authority to enter into agreements with states to collect fees to fund the programs identified in those plans.
- **Agricultural Appropriations Act of May 23, 1908:** This act provides authority for forest officers to assist states in wildlife and fish law enforcement.
- **Fish and Wildlife Coordination Act of 1934:** This act provides that wildlife and fish resources receive equal consideration with other resources in water resource development programs.
- **National Environmental Policy Act of January 1, 1970:** NEPA requires fish and wildlife concerns to be assessed in environmental analyses and EISs.
- **Forest and Rangeland Renewable Resources Planning Act of 1974:** This act provides that wildlife and fish be included in the development of the national resources assessment and related USFS programs.
- **Federal Water Pollution Control Act of July 9, 1956:** The act provides for restoration of water quality to meet national standards.
- **Migratory Bird Treaty Act of 1918:** The MBTA established federal responsibilities for the protection of nearly all migratory species of birds, their eggs, and nests.

Sustainable Ecosystems Strategy

Managing for sustainable ecosystems is an overarching strategy of the LRMP, intended to provide the ecological conditions that maintain or restore the diversity of native ecosystems, which in turn would maintain the diversity and populations of most plant and animal species. See Section 2.1 of the LRMP for a discussion of the SJNF and TRFO sustainable ecosystems strategy. The sustainable ecosystems strategy is intended to create and/or maintain ecological conditions similar to those under which native species evolved, which is likely to offer some assurance against losses of biodiversity (Seymore and Hunter 1999). This strategy is a core component of how the LRMP is intended to maintain habitat conditions suitable for most terrestrial wildlife species and populations well distributed across the SJNF and TRFO. It must be recognized however, that factors outside of the USFS’s and BLM’s control, such as climate change, could create ecological conditions unlike those of the reference period.

The sustainable ecosystems strategy includes 1) the designation and preservation of protected areas (which contain landscape linkage areas and wildlife corridors) where ecological processes can occur with minimal human intervention (a coarse-filter approach); 2) the application of ecosystem management at multiple scales, which includes the maintenance and restoration of the biotic and abiotic components of ecosystems and the implementation of management activities that produce goods and services; 3) the development of LRMP components (desired conditions, objectives, standards, and guidelines) that provide a framework for the management and protection of ecosystems on SJNF and TRFO; 4) monitoring of ecosystems and the effects that management activities are having on the SJNF and TRFO; and 5) adaptive management as needed.

The sustainable ecosystems strategy provides the foundation for maintaining healthy habitats on which terrestrial wildlife species depend. Sustainability of wildlife species and populations across the planning area is dependent in large measure on maintaining healthy, functioning habitats well distributed and interconnected across the planning area. For this reason, the sustainable ecosystems strategy is the key plan design concept that is expected to maintain habitat for terrestrial wildlife throughout the life of the LRMP.

Standards and guidelines describe the environmental protection measures that would be applied to all LRMP alternatives at the project level in order to protect, enhance, and, where appropriate, improve resources related to terrestrial wildlife and wildlife species. Standards and guidelines are presented in the LRMP (Volume II).

3.3.2 Affected Environment

From the public involvement process and review of management challenges unresolved by current management, four primary issues emerged to be addressed by the different alternatives in the FEIS analysis (see Section 2.4). After considering these four planning issues, management challenges or opportunities were developed specific to maintaining the amount, condition, availability, and effectiveness of habitats necessary to support goals for management of terrestrial wildlife habitats, species, and populations. These wildlife management challenges and opportunities were developed from experience implementing the current LRMP, consideration of the four primary plan issues described above, consideration of scoping input from the public, and consideration of input from major partners in wildlife management on the SJNF and TRFO, including CPW and the USFWS. Finally, anticipated future trends in resource conditions affecting wildlife habitats and populations from implementing alternatives of the new LRMP were also considered. The resulting wildlife management challenges and opportunities were used to evaluate LRMP components designed to maintain or improve habitat conditions or capability for terrestrial wildlife and/or address non-habitat factors limiting wildlife species or populations related to agency actions during LRMP implementation.

The management challenges or opportunities identified for terrestrial wildlife habitats, species, and/or populations are used in this FEIS analysis to describe effects of implementing the LRMP, and compare and contrast anticipated general effects on wildlife of implementing each of the alternatives. Given the broad range of terrestrial wildlife species, wide variety of wildlife habitats and key habitat components present on the SJNF and TRFO, and potential for some non-habitat factors to affect wildlife species, it is not possible to describe in detail how every wildlife species or population might be affected by each management challenge. For this reason, each wildlife management challenge is described under a larger group of wildlife species that share commonalities with respect to how they respond to habitat conditions and management challenges. These general wildlife groups, and the management challenges associated with them, are carried through the analysis of alternatives, and analysis of direct, indirect, and cumulative effects on terrestrial wildlife resources.

The eight management challenges and opportunities identified for terrestrial wildlife are:

- Decrease physical fragmentation of key wildlife habitats reducing capability of key wildlife habitats;
- Limit human disturbance that causes declines in effectiveness of key wildlife habitats during sensitive times of year;
- Increase the amount and distribution of mature and old growth ponderosa pine and warm-dry mixed conifer forests to more closely resemble HRV conditions, and improve habitat conditions for wildlife species dependent on forest conditions associated with these habitats;

- Improve the amount (NFS lands) and condition (BLM and NFS lands) of sagebrush habitats, and improve habitat conditions for Gunnison sage-grouse and mule deer (*Odocoileus hemionus*) winter habitat capability;
- Maintain or improve habitat conditions within wildlife travel corridors to maintain or improve movement of animals between seasonal ranges, and maintain or improve connectivity of wildlife populations across large landscapes;
- Maintain or improve ecological function of riparian areas, wetlands, springs and seeps, and maintain or improve habitat conditions for a large number of wetland and riparian dependent wildlife species;
- Reduce the potential for wildlife diseases to affect wildlife populations on the SJNF and TRFO;
- Enhance water quality downstream of abandoned mines to improve habitat capability for wildlife species and populations sensitive to dissolved heavy metals and other contaminants.

Some non-native or exotic species are desired and have substantial recreational value. For example, ring-necked pheasants (*Phasianus colchicus*) and mountain goats (*Oreamnos americanus*) are both introduced species that are desired by the State of Colorado because of their contribution to hunting and wildlife-viewing opportunities. Other exotics (such as European starling [*Sturnus vulgaris*] and bullfrog [*Rana catesbeiana*]), however, have adverse impacts on native species because they displace native species from available habitats. Desirable non-native species, as determined between the BLM, USFS, and CPW, would continue to remain a part of the wildlife diversity objectives of the SJNF and TRFO. The SJNF and TRFO would also continue to work with the State of Colorado in order to control or eliminate undesirable exotic species (including noxious weeds, fish, and invertebrates) that impact native species and their habitats. Management of non-native species is an important part of managing wildlife diversity on the SJNF and TRFO, but at this time there do not appear to be substantial management related issues for terrestrial non-native species for which LRMP components would be needed. For this reason, exotic and/or introduced species are not brought forward as a group or issue for further analysis.

Recent habitat assessments of landscape conditions and trends on lands administered by the SJNF have identified several major factors influencing change in forested and non-forested wildlife habitat conditions that have occurred since early Euro-American settlement. Depending on the vegetation type, these factors include fire exclusion, timber harvesting, road and urban development, livestock grazing, solid and fluid mineral development, and motorized and non-motorized recreational uses associated with a rapidly growing human population. These conditions and trends have implications for wildlife species and populations that include:

- changes in forest structure and composition that contribute to uncharacteristic wildfire behavior in lower-elevation forest types, particularly ponderosa pine and warm-dry mixed conifer forests;
- expansion of road and motorized trail networks that fragment wildlife habitat and increase disturbance to wildlife through associated human activity and habitat loss;
- introduction and expansion of invasive plant species that reduce native plant diversity and associated wildlife habitat capability and connectivity;
- loss and/or degradation of habitats for some wildlife and plant species where human impacts have occurred, and/or where natural disturbance regimes have been altered;
- development and infringement into some traditionally important wildlife habitats (including big game winter range), typically at lower to moderate elevations on non-federal lands adjacent to the

SJNF and TRFO, increasing the importance of wildlife habitats on lands managed by the SJNF and TRFO;

- a rapidly increasing human population that places uses and demands on federal landscapes, reducing habitat security and increasing disturbances to wildlife species, especially within key areas such as winter ranges and production areas; and
- increased demand for mineral development on certain portions of the planning area that is likely to influence some wildlife species and/or their key habitat components.

Most, if not all, of the terrestrial wildlife habitats within the SJNF and TRFO have been utilized by humans for centuries. Within some of the lower-elevation habitat types, ancient Puebloans had a significant impact on the structure, density, and extent of some habitats or their key habitat components. Pinyon-juniper woodland was heavily impacted in some areas from wood gathering and farming practices. In general, the amount of change that occurred after the reference period was greater in the low to moderate elevation habitat types such as pinyon-juniper woodland and ponderosa pine habitats, and was less in higher-elevation habitat types such as spruce-fir forests and alpine tundra habitat types. Usually low-elevation habitats, such as ponderosa pine, riparian areas and wetland ecosystems, and grasslands, underwent the greatest change because they offered highly valued and accessible resources (including water, forage, and timber), while higher-elevation systems (such as alpine tundra and spruce-fir forests) remained relatively less affected. Low elevation habitats were also subject to additional changes through alteration of natural disturbance regimes, including wildfire suppression and flood control.

There are 14 recognized major vegetation types on the SJNF that provide habitat for a wide variety of terrestrial wildlife species. Habitat assessments have been prepared for many of these types, including trends in amount and condition over time. This information was considered in the analysis of habitat condition and trend information that supports wildlife species across the SJNF. These assessments are included in the planning record. Past timber harvesting has influenced many vegetation types, as well as their associated wildlife habitat conditions within the planning area. In general, alterations to vegetation conditions have been more substantial in lower-elevation vegetation types and less substantial in higher-elevation vegetation types. Some loss of ecological function has occurred as a result of these changes, such as in the ponderosa pine and warm-dry mixed conifer types, which are thought to be currently outside their HRV. Therefore, the need for active restoration is greater in some systems such as in ponderosa pine and warm-dry mixed conifer forests, and less in other systems such as spruce-fir and alpine tundra types where deviation from historic conditions is less.

The terrestrial habitat assessments have estimated trends in wildlife habitats and structural stage conditions since the first SJNF plan was signed in 1983. In general, land management activities resulted in only relatively small changes to the vegetation condition across the SJNF since the inception of the San Juan National Forest Land and Resource Management Plan in 1983. Habitat types remain well distributed across the landscape providing continuity and connectivity within and among important wildlife habitats and habitat areas, such as winter ranges and production areas. Trend analysis of major wildlife habitat types across SJNF lands in the planning area estimates that changes within habitat types and structural stages have not exceeded 5% of the overall habitat available across the landscape since the inception of the San Juan National Forest Land and Resource Management Plan in 1983. Most individual structural stages within each habitat type did not vary by more than 2% across the planning area. The observed changes were attributed to a combination of management actions and natural processes such as wildfire and insects and disease. Current habitat conditions, and components of the 1983 San Juan National Forest Land and

Resource Management Plan, have in general been sufficient to sustain wildlife populations well distributed across the planning area and meet state population objectives for wildlife species across the life of the current LRMP.

The current condition and trend of habitats has important implications when considering habitat improvement and restoration priorities. However, the condition and trend of the habitats on private land must also be considered in relation to overall wildlife conservation and biodiversity goals. For example, ownership patterns become more fragmented at lower elevations within the planning area because of interspersion with private land and other in-holdings. Historically, much of this land was utilized by big game species as seasonal winter range. Other wildlife species also migrated to lower elevations during the winter period and/or utilized lower-elevation habitats for dispersal or migration routes. For some species (including Gunnison sage-grouse and Columbian sharp-tailed grouse [*Tympanuchus phasianellus columbianus*]), lands under other ownerships play a key role in their persistence within the planning area. Low-elevation habitats, both on and off the SJNF and TRFO, continue to be vital to the over-winter survival and population objectives of some big game species, including Rocky Mountain elk (*Cervus canadensis nelsoni*) and mule deer.

Human population growth and associated activities, land use conversions, and lack of fire frequency in fire-dependent systems have led to substantial changes in wildlife habitat conditions on private lands adjacent to the SJNF and TRFO. As a consequence of declining amounts and capability of wildlife habitats on private lands adjacent to the planning area, the value of wildlife habitats on the SJNF and TRFO has increased in terms of maintaining local wildlife populations, especially for big game winter ranges. Winter ranges include much of the lower-elevation ecosystems found across the planning area, and adjacent lands under private ownership. Availability of effective winter range is considered to be a limiting factor to big game populations within southwest Colorado. However, at this time, the amount of big game winter range on the SJNF and TRFO is not thought to limit big game populations (USFS 2006b), but could become a limiting factor in the future if the current declining trend of total amount and condition of winter range available across all land ownerships continues.

Approximately 44% of the planning area is in IRAs, BLM WSAs, the Piedra Area, or in designated wilderness areas that often overlap the spruce-fir and alpine vegetation types. IRAs and/or wilderness areas offer large blocks of habitat that are relatively unmanaged and generally less disturbed by humans, and as such are especially valuable for some wildlife species. Large, intact wild areas are a valuable characteristic of the planning area, and these areas would increase in value to terrestrial wildlife resources as the human population of southwest Colorado continues to grow.

Description of Available Habitats

To evaluate the relevance to wildlife resources of the four primary planning issues summarized above (see Section 2.4) in the context of ecological sustainability, it is necessary to provide a brief discussion of the primary wildlife habitats occurring on the SJNF and TRFO (see also Sections 3.1–3.5). Within the planning area, vegetative types vary from alpine (at the highest elevations) to semi-desert shrublands and grasslands (at the lowest elevations). (Vegetation types, and their associated wildlife habitat components, are described in Section 2.1 of Volume II, LRMP; more detailed habitat information can be found in the San Juan Habitat Assessments (USFS 2006-2008). In addition, physical and geological features (such as cliffs, caves, rivers, streams, waterfalls, and open water bodies) also provide important wildlife habitat features within the planning area. Based on species distribution maps for Colorado, this diversity of habitats supports approximately 193 breeding bird species, 87 mammals, 24 reptiles, and 10 amphibians (Fitzgerald et al. 1994; Hammerson 1999; Kingery 1998). Additional species pass through the planning area during migration and/or utilize

habitats on or near the planning area for feeding or resting en route to distant wintering or summering areas.

Vegetation and Wildlife Species Associations

Alpine

There are approximately 172,000 acres of alpine habitats on the SJNF and TRFO, totaling about 8% of the planning area. The trend in amount of alpine habitats is stable, but the trend in condition is gradually upward. Several wildlife species utilize the alpine tundra at least seasonally, and some species depend exclusively upon alpine habitats for breeding or life-cycle requirements. Several species of voles, mice, and shrews occur in alpine tundra vegetation; other species, such as pika (*Ochotona* sp.) and yellow-bellied marmot (*Marmota flaviventris*) occur where boulder fields and rocks are present. Rocky Mountain bighorn sheep (*Ovis canadensis*) and elk (*Cervus canadensis*) utilize alpine habitats during summer but many individuals migrate to lower elevations when winter begins. Alpine tundra is important breeding habitat for local and endemic bird species such as white-tailed ptarmigan (*Lagopus leucura*), American pipit (*Anthus rubescens*), and brown-capped rosy finch (*Leucosticte australis*). Alpine cirques with boulder fell fields offer primary denning habitat for North American wolverine (*Gulo gulo luscus*) in states such as Idaho and Montana, and would provide an important habitat in Colorado if the species is still extant (surviving) (Byrne and Copeland 1997). Alpine tundra in southern Colorado also provides the only known habitat for the Uncompahgre fritillary butterfly (*Boloria acrocnema*).

Aspen Forests

On the SJNF and TRFO, aspen forests occur as pure stands, as pure stands of overstory trees with an understory of young conifer trees, or as a mixed overstory of aspen trees and conifer trees with the most abundant tree species being aspen. The SJNF has some of the most extensive pure aspen stands found in Colorado, but many aspen-dominated habitats on the SJNF and TRFO are a mix of aspen and conifer trees. Where aspen trees intermix with conifer trees, the resulting aspen-dominated forests usually supports a wider variety of wildlife species than conifer-dominated forests nearby. There is approximately 299,000 acres of aspen-dominated habitats on the SJNF and TRFO, about 13% of the planning area. The trend in amount of aspen on the SJNF is stable, but there is a declining trend in the amount of aspen in early successional stages and a trend of increasing conifer succession in the understory of many aspen stands. Aspen-dominated forests are extremely rich habitats for many wildlife species. DeByle (1995) lists 134 species of birds and 56 species of mammals that use aspen habitat types. Amphibians such as northern leopard frog (*Rana pipiens*) are also common because of the moist environments. Typical species associated with aspen habitats within the planning area include red-naped sapsucker (*Sphyrapicus nuchalis*), violet-green swallow (*Tachycineta thalassina*), hairy woodpecker (*Picoides villosus*), purple martin (*Progne subis*), elk, and black bear (*Ursus americanus*), as well as many small mammal species. Aspen is a key nesting habitat for northern goshawk (*Accipiter gentilis*) in much of southern Colorado (Ferland 2005). In the older structural stages, aspen is a key structural attribute for many primary and secondary cavity-nesting birds. As aspen stands on the SJNF and TRFO continue to age, implications for future wildlife habitat conditions include gradual loss of elk calving areas spring and early summer bear forage.

Cool-Moist Mixed Conifer Forests

Cool-moist mixed conifer forest types are often rich in wildlife use. This wildlife richness is due to the variety of aspects and elevations, moisture gradients, tree species mixes, structural stages, and other physical factors that is typical of mixed conifer forests on the SJNF and TRFO. Examples of

associated wildlife species of cool-moist mixed conifer forests include Williamson's sapsucker (*Sphyrapicus thyroideus*), dusky grouse (*Dendragapus obscurus*), northern goshawk, olive-sided flycatcher (*Contopus cooperi*), black bear, elk, and mule deer. In cool-moist mixed conifer forests, species such as Canada lynx (*Lynx canadensis*), snowshoe hare (*Lepus americanus*), wolverine, and American marten (*Martes americana*) may be present as the life zone generally transitions into conditions more common to the higher-elevation forest types. Due to the diversity and variety of physical habitat features, no wildlife species in Colorado is restricted exclusively to cool-moist mixed conifer forests. There is approximately 136,000 acres of cool-moist mixed conifer forests on the SJNF and TRFO, totaling about 6% of the planning area. The trend in amount of cool-moist mixed conifer forests on the SJNF is stable, the trend in relative abundance of structural stages is stable, and the trend in abundance of stands in late-successional condition is also stable.

Warm-Dry Mixed Conifer Forests

Warm-dry mixed conifer forests are also rich in wildlife use. As the name implies, the vegetation mosaic of this vegetation type is generally found at lower elevations where sites are warmer and drier than that of cool-moist mixed conifer forests. The richness of wildlife species using warm-dry mixed conifer forests is due to the variety of aspects and elevations, moisture gradients, tree species mixes, and other structural factors. Examples of associated wildlife species include Williamson's sapsucker, western tanager (*Piranga ludoviciana*), dusky grouse, northern goshawk, Merriam's turkey (*Meleagris gallopavo*), olive-sided flycatcher, flammulated owl (*Otus flammeolus*), black bear, elk, and mule deer. In warm-dry mixed conifer forests, species such as pygmy nuthatch (*Sitta pygmaea*) and western bluebird (*Sialia mexicana*) may be more abundant as this life zone generally transitions into lower-elevation forest types. Again, due to the diversity and variety of physical habitat features, no species in Colorado is restricted exclusively to warm-dry mixed conifer forests. There is approximately 116,000 acres of warm-dry mixed conifer forests on the SJNF and TRFO, totaling about 5% of the planning area. The trend in amount of warm-dry mixed conifer forests on the SJNF is stable, the trend in relative abundance of structural stages is stable, and the trend in abundance of stands in late-successional condition is also stable. Many decades of fire suppression, timber harvest, and livestock grazing have caused gradual but substantial shifts in tree species, structural stage composition, and fire frequency, resulting in many warm-dry mixed conifer stands now being considered to be outside their historic range of variability (see Section 3.2, Terrestrial Ecosystems and Plant Species). Currently, warm-dry mixed conifer forests have less acres in the old growth development stage and have less diversity and distribution of native grasses compared to HRV conditions, with implications for wildlife species and populations that are most closely associated with those development stages.

Mountain Grasslands

There is about 140,000 acres of mountain grasslands on the SJNF and TRFO, totaling about 6% of the planning area. The trend in amount of grasslands on the SJNF is stable, but the trend in grassland condition is gradually upward. Mountain grasslands are rich in small mammal species, such as voles and shrews, and several fossorial mammals, such as marmots, badgers, and pocket gophers (which occur most frequently in grasslands or on grassland/rock edges). Mountain grasslands are especially important to deer, elk, and bighorn sheep for foraging. Within the planning area, all of the big game species utilize different elevational grasslands on a seasonal basis. The diversity and density of bird species in these grasslands varies, depending on elevation. Many species of sparrows and other ground-nesting birds are associated primarily with this vegetation type. In general, mountain grasslands do not support many species of reptiles or amphibians, except where water, cliff/rock, or other unique features are present.

Mountain Shrublands

There is about 242,000 acres of mountain shrublands on the SJNF and TRFO, totaling about 11% of the planning area. The trend in amount of mountain shrublands on the SJNF is stable (comparable data for TRFO lands is not available). Mountain shrubland habitats provide valuable food and cover for many wildlife species, and some species (such as black bears) depend heavily upon the mast crops that can be abundant in this vegetation type. Primary shrub species found in this association on the SJNF and TRFO include Gambel oak, chokecherry, serviceberry, snowberry (*Symphoricarpos* sp.), bitterbrush (*Purshia* sp.), and mountain mahogany. Fewer small rodent species utilize mountain shrubland habitats in Colorado, but some small mammals (such as Nuttall's cottontail [*Sylvilagus nuttallii*]) may reach high densities. Mountain shrublands are important fall habitats for black bear foraging in preparation for hibernation. At least 24 bird species in Colorado utilize mountain shrublands. Local bird species that are closely associated with this vegetation type include green-tailed (*Pipilo chlorurus*) and spotted towhee (*P. maculatus*), Virginia's warbler (*Oreothlypis virginiae*), and Merriam's turkey. Mountain shrublands, especially where intermixed with mountain grasslands, are heavily used by big game animals as transition range and primary winter range.

Pinyon-Juniper Woodlands

Pinyon-juniper woodlands on the SJNF and TRFO are a mixture of two tree species, pinyon pine and Utah juniper. The relative mix of these two species varies substantially from site to site. There is about 217,000 acres of pinyon-juniper woodlands on the SJNF and TRFO, totaling about 9% of the planning area. The trend in amount of pinyon-juniper woodlands on the SJNF is stable (comparable data for TRFO lands is not available), the trend in relative abundance of structural stages is stable, but the recent trend in relative abundance of pinyon pine has been slightly downward due to Ips beetle activity in recent years. Pinyon-juniper woodlands often support a rich and diverse wildlife community. These woodlands are very important to avian species and support the largest assemblage of nesting bird species of any upland vegetation type in the western United States. Typical bird species that utilize local pinyon-juniper habitats include Lewis's woodpecker (*Melanerpes lewis*), pinyon jay (*Gymnorhinus cyanocephalus*), loggerhead shrike (*Lanius ludovicianus*), gray vireo (*Vireo vicinior*), and mountain chickadee (*Poecile gambeli*). Pinyon-juniper habitats are utilized by many big game species, at least on a seasonal basis, and may provide year-round habitat for mule deer and elk when food and water resources are available. Numerous small mammal species occupy pinyon-juniper habitats, including deer mouse (*Peromyscus* sp.), white-footed mouse (*P. leucopus*), bushy-tailed woodrat (*Neotoma cinerea*), and white-tailed jackrabbit (*Lepus townsendii*). Large carnivores (such as mountain lion [*Puma concolor*]) also frequent pinyon-juniper habitats, especially when prey species such as mule deer are available. The diversity of reptile species within pinyon-juniper woodlands is nearly as high as that encountered in semi-desert shrublands, and species such as western rattlesnake (*Crotalus oreganus*) may be most common in this habitat type. Pinyon-juniper habitats support the highest diversity of bat species in Colorado. This is especially valuable where wetlands and riparian habitats are intermixed with pinyon-juniper uplands. Bat species such as fringed myotis (*Myotis thysanodes*) and spotted bat (*Euderma maculatum*) also utilize pinyon-juniper trees and associated cliff and rock habitats as roosting areas. In general, amphibian species are scarce in pinyon-juniper woodlands, except where water is available.

Ponderosa Pine Forests

There is approximately 259,000 acres of ponderosa pine forests on the SJNF and TRFO, totaling about 11% of the planning area. The trend in amount of ponderosa pine forest on the SJNF is stable (comparable data for TRFO lands is not available), the trend in relative abundance of structural

stages is stable, and the trend in abundance of stands in late-successional condition is also stable. Many decades of fire suppression, timber harvest, and livestock grazing have caused gradual but substantial shifts in tree species mixes and structural stage and understory composition, resulting in many ponderosa pine stands now being considered to be outside their historic range of variability (see Section 3.2, Terrestrial Ecosystems and Plant Species). Currently, ponderosa pine forests have fewer acres in the old growth development stage and less diversity and distribution of native grasses compared to HRV conditions, with implications for wildlife species and populations that are most closely associated with those development stages. Ponderosa pine forests support a rich and diverse wildlife community, including some habitat specialists that reach their highest densities in this vegetation type. Ponderosa pine habitat specialists include Abert's squirrel (*Sciurus aberti*) and band-tailed pigeon (*Patagioenas fasciata*). Ponderosa pine forests are used extensively by big game species (such as mule deer and elk) and may be particularly important as transitional habitat or winter range areas. The understory of ponderosa pine forests varies from open grass to dense Gambel oak, supporting a wide variety of bird and mammal species. Large-diameter standing snags and varying tree densities and stand configurations supports a wide diversity of arboreal mammals and birds. Large carnivores (such as mountain lion) also frequent ponderosa pine forests, especially when prey species such as mule deer are available.

Riparian Areas and Wetlands

There is approximately 32,000 acres of riparian areas and wetlands on the SJNF and TRFO, totaling about 1% of the planning area. The trend in amount of riparian and wetland habitats on the SJNF is likely to be either generally slightly downward due to persistent drought and gradually increasing demand for water uses. The trend in condition of riparian areas and wetlands is likely to also be generally slightly downward for the same reasons. In Colorado, it is estimated that at least 40% of all vertebrate species are closely associated with riparian habitats (Hoover and Wills 1984). These species include approximately 70% of the breeding birds in Colorado, as well as big game species, small mammals, furbearers, and a variety of other non-game species. Riparian areas and wetlands ecosystems within the planning area also support a high number of amphibians and reptiles. All local bat species concentrate around riparian habitats for foraging and drinking purposes. For this reason, slow-water pools and open wetlands are especially important.

Sagebrush Shrublands

There are about 85,000 acres of sagebrush shrublands on the SJNF and TRFO, totaling about 4% of the planning area. Sagebrush shrubland habitat capability is being reduced in some areas of the SJNF and TRFO through encroachment of pinyon-juniper woodlands and invasion of non-native cheatgrass that replaces native grasses and forbs in the sagebrush understory. Sagebrush shrublands represent an extremely important vegetation type to many wildlife species, especially birds. Some of the highest densities of wintering mule deer on the SJNF and TRFO are found in sagebrush shrubland habitats. Many of the birds that occur in this type are sagebrush obligate species that exhibit sensitivity to habitat edges and fragmentation. Many of these species also nest on, or near, the ground beneath the shrubs, and are, therefore, vulnerable to impacts. Examples of local sagebrush shrubland obligate bird species include sage sparrow (*Artemisiospiza belli*), Brewer's sparrow (*Spizella breweri*), sage thrasher (*Oreoscoptes montanus*), and Gunnison sage-grouse, which is a BLM sensitive species and proposed for listing under the ESA. Sage-grouse are found in the west and northwest portions of the planning area. Sagebrush shrublands support many of the small mammal species that are also found in mountain shrubland and pinyon-juniper woodland habitats. These three wildlife habitats are often intermixed and/or transition into each other. Some jackrabbit and cottontail species may reach high population densities in this habitat type. As with

mountain shrublands, sagebrush shrublands can support a high diversity of reptile species, especially when interspersed with semi-desert shrublands, rock/cliff habitats, and other dry habitat types. Amphibians however, are generally absent, except where water sources are present.

Semi-desert Shrublands/Grasslands

There is about 64,000 acres of semi-desert shrublands/grasslands on the SJNF and TRFO, totaling about 3% of the planning area. Numerous small mammal species occur in semi-desert shrublands/grasslands habitats, including kangaroo rat (*Dipodomys* sp.), deer mouse, Wyoming ground squirrel (*Urocitellus elegans*), and Gunnison’s prairie dog (*Cynomys gunnisoni*). Where Gunnison's prairie dog colonies occur, they function as a keystone species, providing burrows, vegetation structure, and an abundance of prey that attracts and supports a variety of other species that otherwise would be unlikely to occur in similar densities, such as badger, burrowing owl (*Athene cunicularia*), and ferruginous hawk (*Buteo regalis*). Mule deer and antelope also use semi-desert shrublands/grasslands, especially during winter. The diversity and density of bird species is typically low in semi-desert shrublands with the most common species assemblage dominated by horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), mourning dove (*Zenaida macroura*), and ash-throated flycatcher (*Myiarchus cinerascens*). However, semi-desert shrublands support specialized species such as loggerhead shrike and provide important nesting and/or foraging habitat for several raptors of local concern including burrowing owl, prairie falcon (*Falco mexicanus*), and golden eagle (*Aquila chrysaetos*).

Spruce-fir Forests

On the SJNF and TRFO, spruce-fir forests are a mixture of two species, Engelmann spruce and subalpine fir. The relative mix of these two species varies substantially from site to site. There is approximately 509,000 acres of spruce-fir forests on the SJNF and TRFO, totaling about 22% of the planning area, and the largest amount of any individual wildlife habitat type on the SJNF and TRFO. The trend in amount of spruce-fir forest on the SJNF is stable (comparable data for TRFO lands is not available), the trend in relative abundance of structural stages is stable, and the trend in abundance of stands in mature and late-successional condition is also stable. Spruce-fir forests are rich in mammal and bird species, but they support relatively few reptile or amphibian species because of the higher elevations. Extensive mortality of mature trees has occurred over the last few years from spruce bark beetle impacts. In some areas, the majority of mature spruce and fir trees have been recently killed from insects and disease. One amphibian species of interest, the boreal toad (*Bufo boreas boreas*) (which has historic occurrence within the planning area but is not known to currently occur) is closely associated with streams and wetlands within spruce-fir forests. Other species closely associated with spruce-fir forests include southern red-backed vole (*Myodes gapperi*), American marten, Canada lynx, American three-toed woodpecker (*Picoides dorsalis*), boreal owl (*Aegolius funereus*), olive-sided flycatcher, golden-crowned kinglet (*Regulus satrapa*), Hammond's flycatcher (*Empidonax hammondii*), and hermit thrush (*Catharus guttatus*). Spruce-fir forests are also important to big game animals, such as mule deer and elk during summer, and moose (*Alces alces*) year around. When geological features such as rocks and cliffs are present, spruce-fir forests also support specialized species such as pika and yellow-bellied marmot (*Marmota flaviventris*).

Description of Categories of Species

The categories and types of wildlife species within the planning area reflect the wide diversity of available terrestrial wildlife habitats. Some species, such as mule deer and Rocky Mountain elk, are steeped in local culture and tradition and have long been important to local peoples and communities for economic and aesthetic reasons. Many non-game species have recently gained recognition for

the economic, aesthetic, and ecological values they provide. For example, resident and migratory bird species as a resource in the United States generate over $85 billion in overall economic output and are enjoyed by over 46 million people (USFWS 2003a). Migratory birds are also recognized for the ecological values they provide in terms of insect control, pollination, and seed dispersal. Some wildlife species that occur within the planning area are migratory and/or wide-ranging and can therefore utilize multiple habitat types throughout the year, while other species are more sedentary and utilize relatively few habitats or individual components within a single habitat type. All species, however, contribute to, or influence, the ecological processes that maintain biodiversity within the planning area.

Species assessments have been prepared for many species, both at the level of the SJNF and the USFS regional level. These species assessments bring together available information at differing scales for the species of interest in order to help assess the habitats they utilize along with management information and research needs. The information contained in these species and habitat assessments is referenced and included in the planning record and was used in assessing species and habitats across the planning area. Table 3.3.1 lists SJNF and USFS Region 2 species and habitat assessments reviewed for the planning process. Species assessments have not been completed for the TRFO.

Table 3.3.1: SJNF and USFS Region 2 Wildlife Species and Terrestrial Habitat Assessments

SJNF Habitat Assessments	
Alpine tundra	Aspen
Mixed conifer	Mountain grasslands
Pinyon-juniper	Ponderosa pine
Riparian and wetlands	Sagebrush
Spruce-fir	
SJNF Species Assessments - Amphibians	
Boreal toad	Northern leopard frog
Red Spotted toad	Western chorus frog
Woodhouse toad	
SJNF Species Assessments – Birds	
American bittern	Black swift
Boreal owl	Bald eagle
Brown creeper	Chipping sparrow
Columbian sharp-tailed grouse	Common loon
Dark-eyed junco	Ferruginous hawk
Flammulated owl	Grace’s warbler
Greater sandhill crane	Green-tailed towhee
Golden-crowned kinglet	Hairy woodpecker
Lewis’s woodpecker	Lincoln’s sparrow
Loggerhead shrike	Mallard duck
Merriam’s wild turkey	Mexican spotted owl
Mountain bluebird	Northern goshawk
Olive-sided flycatcher	Peregrine falcon
Purple martin	Pygmy nuthatch
Red-naped sapsucker	Red-shafted flicker
Ruby-crowned kinglet	Spotted towhee
Southwestern willow flycatcher	Three-toed woodpecker
Virginia’s warbler	Warbling vireo
Western burrowing owl	Western tanager
Wilson’s warbler	White-faced ibis
Yellow warbler	

SJNF Species Assessments - Mammals	
Abert's squirrel	American black bear
American marten	Beaver
Bushy-tailed woodrat	Canada lynx
Deer mouse	Dwarf shrew
Elk	Mule deer
Montane vole	Northern pocket gopher
North American river otter	Ringtail
Townsend's big-eared bat	Wolverine
SJNF Species Assessments – Insects	
Uncompahgre fritillary butterfly	
Region 2 Species Conservation Project, Species Assessments – Birds	
American bittern	American three-toed woodpecker
Baird's sparrow	Black swift
Black tern	Brewers sparrow
Burrowing owl	Cassin's sparrow
Columbian sharp-tailed grouse	Ferruginous hawk
Fox sparrow	Green-tailed towhee
Grasshopper sparrow	Long-billed curlew
Lewis's woodpecker	Lincoln's sparrow
Loggerhead shrike	Mountain bluebird
Northern goshawk	Northern harrier
Olive-sided flycatcher	Pinyon jay
Purple martin	Pygmy nuthatch
Sage sparrow	Short-eared owl
Wilson's warbler	White-tailed ptarmigan
Yellow-billed cuckoo	
Region 2 Species Conservation Project, Species Assessments – Reptiles	
Smooth green snake	
Region 2 Species Conservation Project, Species Assessments – Amphibians	
Boreal toad	Northern leopard frog
Region 2 Species Conservation Project, Species Assessments – Mammals	
Abert's squirrel	Fringed myotis
North American beaver	North American river otter
Pine squirrel	Snowshoe hare
Townsend's big-eared bat	Rocky Mountain bighorn sheep
Region 2 Species Conservation Project, Species Assessments – Insects	
Great Basin silverspot butterfly	

Management challenges and opportunities for terrestrial wildlife habitats, species, and/or populations were developed as a way to describe effects of implementing the LRMP, and compare and contrast anticipated general effects on wildlife of implementing the alternatives. The wildlife species and habitat assessments described above were used as important resources for analyzing effects of implementing LRMP direction, guidance, and alternatives on wildlife habitats, species, and populations over the life of the LRMP. Given the broad range of wildlife species, and the wide variety of habitats upon which they depend, it is not possible to analyze and describe all wildlife species affected by each management challenge and opportunity. For this reason, each wildlife management challenge and opportunity would be described below under a group of wildlife species that share commonalities with respect to how they respond to habitat conditions and management actions. These general wildlife groups, and the wildlife management challenges and opportunities associated with each group, are described below.

The analyses presented below use the best available science, published and peer-reviewed scientific literature, unpublished local information, surveys and reports, and the professional opinions of federal and state wildlife managers with extensive knowledge of the local landscapes. All materials were used as supporting information to arrive at the conclusions presented. The best available source of mapping products that display ranges of game and non-game wildlife species on SJNF and TRFO administrative units is CPW. The USFWS is the best available source of mapping products for ranges of federally listed species. Mapping products for both agencies were used extensively in support of the analyses presented. Maps submitted by non-governmental organizations were also reviewed, where appropriate.

Amphibians and Reptiles

Amphibians and reptiles occur in a variety of habitats across SJNF and TRFO landscapes. More than 20 species of amphibians and 20 species of reptiles are known to occur within Colorado's San Juan River and Dolores River drainage basins. Amphibians, including toads, frogs, and salamanders, are generally found in the wetter riparian and wetland environments from alpine habitats through the semi-desert shrublands/grasslands habitats. Some have adapted to the harsh, intermittent moisture regimes found in the drier semi-desert and low-elevation canyon environments, including species such as canyon tree frog (*Hyla arenicolor*) and New Mexico spadefoot toad (*Spea multiplicata*). Amphibians are also found in colder environments of the upper montane forests and alpine habitats, including species such as tiger salamander (*Ambystoma tigrinum*) and boreal toad. Special status sensitive species for BLM and NFS lands include canyon tree frog, northern leopard frog, and boreal toad. Canyon tree frog and northern leopard frog are known to occur in the planning area. Boreal toad, however, is not known to currently occur in the planning area. Several boreal toad historic sites are known on the SJNF and TRFO, but surveys have failed to detect toads for many years and the historic sites are presumed to now be vacant.

Reptiles generally inhabit warmer and drier sites in the moderate to lower-elevation habitats across the planning area. Most reptiles in the planning area are composed of species of snakes and lizards. No native populations of turtles or tortoises occur in the planning area, although some introduced populations exist. The western rattlesnake is the only venomous viper occurring in the planning area. While it does occur in many of the lower-elevation habitats, it is not considered abundant in any habitats. Other snake species that occur in the planning area include garter snakes (*Thamnophis* sp.), bullsnake (*Pituophis catenifer sayi*), striped whipsnake (*Masticophis taeniatus ornatus*), and common kingsnake (*Lampropeltis getula*). A variety of lizard species occur across the planning area, including short-horned lizard (*Phrynosoma hernandesi*), sagebrush lizard (*Sceloporus graciosus*), collared lizard (*Crotaphytus collaris*), whiptails (Teiidae), skinks (Scincidae), and tree lizard (*Urosaurus ornatus*). Two special status sensitive species of lizard are found along the westernmost habitats of TRFO lands, long-nosed leopard lizard (*Gambelia wislizenii*) and desert spiny lizard (*Sceloporus magister*).

Invertebrates

Invertebrates are the most abundant and diverse type of terrestrial species in the planning area. Invertebrates are found in all habitats that occur in the planning area and include common types such as mosquitoes (Culicidae), flies (Diptera), spiders (Araneae), ants (Formicidae), butterflies (Rhopalocera), and beetles (Coleoptera). Many of these types include species and subspecies that have special adaptations allowing them to take advantage of specialized niches within a specific habitat type. When environmental conditions are favorable, some invertebrate populations in local areas can increase to the point where impacts of their large populations can negatively affect

resources important to people. A recent example within the planning area is a bark beetle outbreak that substantially reduced pinyon pine abundance within the pinyon-juniper habitat type on some of the western portions of the planning area. A similar type of outbreak is currently occurring in the subalpine spruce-fir forests of eastern portions of the planning area that is causing substantial mortality of mature Engelmann spruce trees.

Most invertebrate species are abundant with no concern for population sustainability across the SJNF and TRFO. There are two invertebrate species of conservation concern that occur in the planning area. The Nokomis fritillary butterfly (*Speyeria nokomis*), also known as the Great Basin silverspot, is rare within lower elevations of the planning area and is both a BLM and USFS sensitive species. The Great Basin silverspot requires a particular violet, northern bog violet (*Viola nephrophylla*), as a host plant on which to lay its eggs. This plant may occur around springs, seeps, wetlands, and riparian areas in the planning area but is not considered to be widespread or abundant. The butterfly’s eggs over-winter, with flight generally occurring from late July through mid-September. Nectar sources for adult butterflies primarily involve thistle species. The other butterfly for which there is conservation concern is the federal endangered Uncompahgre fritillary butterfly (*Boloria acrocnema*). The Uncompahgre fritillary butterfly requires snow willow (*Salix nivalis*) as a host plant on which to lay eggs and as the primary food source for larvae. The species requires large patches of snow willow within the alpine zone, above 12,500 feet, with the presence of other additional site-specific environmental factors for suitable habitat. Only one known area of occupation occurs in the planning area, and habitat inventories have found little to no additional suitable habitat on SJNF and TRFO.

Migratory Birds

It is estimated that the planning area may support approximately 193 species of breeding birds, as well as additional species that utilize stop-over habitats during their annual migration. Of these 193 species of breeding birds, approximately 74 species are considered neotropical migratory birds that breed on or near the planning area but winter south of the United States/Mexico border. Most migratory bird species are still common; however, some populations are declining. Neotropical migratory birds are of particular concern within the planning area because of the international issues associated with their conservation. In addition to neotropical migratory birds, a variety of other migratory bird species breed in the planning area but do not generally move south of the United States/Mexico border. Some of these species simply move to lower elevations for the winter, while others move south for varying distances but generally remain within the continental United States.

The SJNF and TRFO planning area contains large areas of various habitats important to migratory birds, including spruce-fir, pinyon-juniper, aspen, mixed conifer, and ponderosa pine woodlands, as well as sagebrush shrublands, mountain shrublands, mountain grasslands, and alpine tundra. Habitats that make up smaller portions of the land base, such as riparian areas and wetland ecosystems, are also of conservation concern due to their critical importance to breeding and migrating birds, as well as to other wildlife groups.

Attention to specific species, or to groups of species, is an important aspect of bird conservation within the planning area. Examples of groups of species include the Birds of Conservation Concern list produced by the USFWS (2008) and the priority species and habitats identified in the Colorado Landbird Conservation Plan (Beidleman 2000). The Birds of Conservation Concern list was produced to highlight species of particular interest within large geographic areas of the United States, referred to as Bird Conservation Regions (BCRs). The Colorado Landbird Conservation Plan (Beidleman 2000) provides information for more localized bird conservation priorities. Lands administered by the SJNF and TRFO occur within the Southern Rockies/Colorado Plateau BCR (BCR 16), which

encompasses portions of Colorado, New Mexico, Arizona, Utah, and Wyoming. The Birds of Conservation Concern list for BCR 16 includes 29 species, some of which do not occur or would be considered accidental within the planning area.

The MBTA of 1918 applies to most birds that are known to occur on the SJNF and TRFO (USFWS 2005). EO 13186 (January 17, 2001), entitled “Responsibilities of Federal Agencies to Protect Migratory Birds,” outlines a collaborative approach to promote the conservation of migratory bird populations. This EO directs federal agencies to take certain actions to further implement the migratory bird conventions of the MBTA, the Bald and Golden Eagle Protection Act, and other pertinent statutes. Following direction in the EO, the BLM and the USFS each signed a Memorandum of Understanding (MOU) with the USFWS that describes opportunities to strengthen bird conservation actions within their existing programs and jurisdictions (BLM 2010b; USFS 2008a). This is accomplished by identifying and implementing strategies that promote bird conservation and avoid or minimize adverse impacts on migratory birds. Each MOU identifies specific activities where cooperation between the agencies would contribute to the conservation of migratory birds and their habitats. These activities are intended to complement and support existing partnerships and facilitate new collaborative conservation strategies and comprehensive planning efforts for migratory birds. Given the recommendations made for each agency in their respective MOUs, the SJNF and TRFO would strengthen bird conservation in the planning area by participating where possible in partnership opportunities and implementing bird conservation actions as described in their respective MOUs.

There is great diversity in migratory birds that use the SJNF and TRFO administrative units. Within the planning area approximately 350 bird species are known to occur, are thought likely to occur, or have habitat within the planning area and/or use the SJNF and TRFO at some time during the year. Not all bird species occur within the planning area every year or during every season (nesting, migration, and wintering seasons). Some birds, such as Williamson’s sapsucker and northern goshawk, nest and forage in a wide variety of habitat types. Other species, such as golden eagle (*Aquila chrysaetos*) and prairie falcon, nest in one habitat type (e.g., rock cliffs), but forage in other habitat types (e.g., grassland and desert shrubland). Also, some species that breed within the planning area, such as black-throated gray warbler (*Setophaga nigrescens*) and cordilleran flycatcher (*Empidonax occidentalis*), leave in late summer for remote wintering areas in Central and South America and are often referred to as Neotropical migratory birds. Other species, such as Clark’s nutcracker (*Nucifraga columbiana*) and pinyon jay, can be found within the planning area throughout the year. Finally, some species are habitat specialists associated primarily with distinct and/or rare habitat conditions, such as black swift (*Cypseloides niger*) (nesting exclusively at waterfalls) and American dipper (*Cinclus mexicanus*) (nesting on cliffs over flowing mountain creeks). Other species, such as red-tailed hawk (*Buteo jamaicensis*) and American robin (*Turdus migratorius*), are habitat generalists that nest in a wide variety of habitats and across most elevations within the planning area. Due to the large number of migratory bird species, and due to the broad range of habitats and seasons of occurrence of migratory birds within the planning area, all of the alternatives may, in some way, impact habitat capability for migratory birds.

Given the great diversity of ecological requirements and potential responses to land management actions by bird species that occur on SJNF and TRFO administrative units, the LRMP focuses its analysis on several key groups of migratory birds for which land management actions are more likely to impact habitat conditions or populations. Key groups of migratory bird species include those listed under the ESA (such as southwestern willow flycatcher [*Empidonax traillii extimus*]), species designated as game species, both upland and waterfowl (such as Columbian sharp-tailed grouse), species of conservation concern (such as Gunnison sage-grouse), raptors that have known sensitivity to some land management programs (such as northern goshawk), and groups with unique habitat

needs (such as cavity nesters and snag-dependent species). Currently, some portions of the planning area are considered to have snag densities well below levels necessary to sustain populations of snag-dependent birds. As a result, the Pagosa and Columbine Ranger Districts implemented limitations on cutting large-diameter ponderosa pine snags for personal use firewood. Program areas that may have the greatest potential influence on key migratory bird groups include timber resources, travel management, fire and fuels, livestock grazing, and mineral development.

Wildlife Issues Related to Migratory Birds

Disturbance and Habitat Effectiveness: As discussed previously, the growing human population, increasing demand for recreational opportunities, and expansion of human activity into a variety of previously more secure wildlife habitat areas, including areas where direct human influences were previously minor or absent, are expected to continue over the life of the LRMP. This trend of increased recreation and overall human activity during the past 30 years is expected to continue and likely increase for the foreseeable future. As a consequence, the amount, condition, and effectiveness of some wildlife habitats are expected to decline for the foreseeable future without the application of additional management guidance. Other forms of human disturbance, in addition to recreation, have also increased substantially over the past 30 years. During this time, some portions of the SJNF and TRFO have seen expansions of road networks for the development, operation, and maintenance of leasable minerals and management of timber resources and other forest products. Over the past 10 years, a growing number of mechanical habitat management projects have been implemented across the planning area. Together, these activities have reduced habitat effectiveness for some migratory birds.

A wildlife management challenge on the SJNF and TRFO is to maintain or improve habitat conditions around raptor focal sites, including historically used platform nests, cliff complexes, and winter roost tree stands, in an environment of continually changing and in some cases increasing requests for opportunities for multiple uses of public lands. There has been a trend of increased recreation and overall human activity on the SJNF and TRFO over the life of the current LRMP. Based on projected activities under the LRMP and projected population growth in the counties within and around the SJNF and TRFO, the trend of increasing human activity on public lands is expected to continue for the foreseeable future and the life of the LRMP. Many raptors, including hawks, eagles, falcons, owls, and osprey (*Pandion haliaetus*), nest in large platform stick nests or on cliff faces, and use the same nest structures or cliff complexes continuously for many consecutive years (Smith et al. 2010). The success and long-term productivity of local populations, and continued use of winter roost sites, is dependent on maintaining the availability of a relatively small number of focal sites such as historically used nest structures, cliff complexes, and roost tree stands. Reducing the potential negative effects of human disturbance or habitat alteration around raptor focal sites is important for maintaining productivity and occupancy of these focal sites (Harness 2007; Rosenfield et al. 2007; Smith et al. 2010; White and Thurow 1985). Raptors can be vulnerable to loss of habitat effectiveness because they often occur at lower densities than many other bird species, are dependent on unique habitat features that are often limited on the landscape such as cliff complexes and unusual nest tree requirements, and because many raptor species have demonstrated sensitivity to human disturbance (Rosenfield et al. 2007; Smith 1988). Conversely, some raptor species and individuals have demonstrated tolerance of human activities in close proximity to historic nesting sites (Bird et al. 1996; Cade et al. 1996; Rosenfield et al. 1996) so raptor protection measures should allow site specific flexibility in their application to provide for continuation of human activities that have coexisted with successful raptor nests (Romin and Muck 2002). Application of management strategies or mitigation measures that limit disturbance and maintain key habitat features at and near individual

raptor focal sites is important for the conservation of local raptor populations (CPW 2008; Fuller 2010; Romin and Muck 2002).

Raptor species that occur on the SJNF and TRFO and for which there is management concern include bald (*Haliaeetus leucocephalus*) and golden eagle (agency sensitive species and Bald and Golden Eagle Protection Act), Mexican spotted owl (*Strix occidentalis lucida*) (listed as threatened under the ESA), peregrine falcon (*Falco peregrinus*) (agency sensitive species), northern goshawk (agency sensitive species), ferruginous hawk (agency sensitive species), osprey, prairie falcon, burrowing owl (agency sensitive species), and northern harrier (birds of conservation concern, Partners in Flight). Although some raptor species are quite rare on the SJNF and TRFO, such as Mexican spotted owl and burrowing owl, most raptor species and populations are believed to be stable or slightly increasing in abundance over the past 30 years.

In response to the management challenge of maintaining raptor populations along with increasing multiple uses, standards and guidelines were developed to maintain or improve habitat conditions around raptor focal sites, including historically used platform nests, cliff complexes, and winter roost tree stands. These standards and guidelines recognize that some individual raptors have demonstrated high tolerance for human activities and have chosen to nest or roost in close proximity to sources of a wide variety of human activity. For this reason, standards and guidelines provide site-specific management flexibility around raptor focal sites where there has been a demonstrated history of tolerance of human activities.

Increase Mature and Old Growth Ponderosa Pine and Warm-dry Mixed Conifer Forests: Ponderosa pine and warm-dry mixed conifer forests on the SJNF and TRFO are thought to differ substantially from HRV conditions in terms of vegetation stand structure and fire frequency (see HRV discussion in Section 3.2, Terrestrial Ecosystems and Plant Species). In particular, ponderosa pine and warm-dry mixed conifer forests have substantially fewer acres in old growth and in the old growth development stage than would be expected under HRV. For wildlife species associated with and/or dependent upon the habitat structural attributes and forest conditions most commonly found in old growth and old growth development stages, there is less habitat availability and capability today than would be expected under HRV conditions. Increasing the abundance and/or distribution of old growth and old growth development stages of ponderosa pine and warm-dry mixed conifer forests, and the wildlife species associated with them, is a management opportunity for the SJNF and TRFO as LRMP implementation activities move ponderosa pine and warm-dry mixed conifer forests towards conditions more similar to those expected under HRV.

From a wildlife perspective, disturbance ecology is important because the life history patterns and responses of many terrestrial species have evolved together with particular disturbance regimes and habitats (Agee 1998; Lyon et al. 2000). Disturbance factors such as wind throw, avalanches, insects and disease, floods, and wildfire are all important natural disturbance processes that help shape landscapes and influence wildlife species in the southern Rocky Mountains.

The alteration of natural fire regimes through fire suppression, livestock grazing, and logging has probably influenced every upland forest vegetation type within the planning area (Saab et al. 2005). The most profound alterations, however, have occurred in the lower-elevation habitat types, primarily ponderosa pine and warm-dry mixed conifer forests where tree species composition and forest stand structure was maintained by frequent low severity fire events (Bock and Block 2005). Higher-severity fires did historically occur in some ponderosa pine forests, but they were more rare than under current conditions (Bock and Block 2005; Saab et al. 2005).

A primary goal of the LRMP is to restore fire-adapted ecosystems to conditions that better reflect their historic disturbance regimes. This would be accomplished by returning fire to the landscape, where fuel conditions and other factors allow, and under certain parameters approved in a fire use prescription. In some cases and under certain circumstances, prescribed fires cannot be used as an initial management tool. This is because several fire-return intervals have been missed and the existing fuels cannot be burned within the accepted parameters. In this case, mechanical fuels reduction may be used as a disturbance agent to achieve initial fuel reduction objectives such that fire could be returned in a manner that better reflects the low-intensity, low-severity fires that were more common during the reference period. In some locations, mechanical fuels reduction would be utilized instead of prescribed burns, due to safety concerns, other resource concerns, or other factors. In upper-elevation forest vegetation types where the fire regime was characterized by mixed- or high-severity fires, the SJNF and TRFO would also utilize natural wildfires, where and when they can be managed within acceptable parameters. Some researchers suggest, however, that low intensity prescribed fire may not replicate historical conditions in mixed fire regimes, which include many mixed conifer forests and subalpine forests of the Rocky Mountains (Saab et al. 2005).

In addition to bringing fire back into a more prominent role in ecological function, the SJNF and TRFO would focus on identifying stands and retaining ecological function in ponderosa pine and warm-dry mixed conifer stands that display characteristics of old growth and old growth development stages. Focus would also be placed on management actions that serve to increase the extent and distribution of these stands across the planning area. This focus is expected to move ponderosa pine and warm-dry mixed conifer forests more towards conditions expected under HRV during the reference period, thereby improving habitat conditions and capability for wildlife species most closely associated with these ecological attributes. Wildlife species that are most closely associated with these ecological attributes in ponderosa pine and warm-dry mixed conifer forests include Abert's squirrel and numerous bat species and bird species.

Bird species for which there is management concern that are closely associated with late successional stand attributes in ponderosa pine and warm-dry mixed conifer forests include pygmy nuthatch, brown creeper (*Certhia americana*), flammulated owl, and Williamson's sapsucker. The primary structural habitat attribute to which these species are most closely associated is standing snags and snag replacement trees of relatively large diameter (greater than 16 inches diameter at breast height [dbh]). Past management actions, particularly timber harvest practices and other management actions, have reduced the number and distribution of large-diameter standing snags on the SJNF and TRFO well below those expected under HRV conditions, reducing habitat value for snag and cavity dependent bird species. In response to this management challenge and wildlife habitat improvement opportunity, standards and guidelines were developed to maintain and improve the abundance and distribution of large-diameter standing snags and snag replacement trees, especially in ponderosa pine and warm-dry mixed conifer forests.

Maintain or Improve Riparian Areas, Wetlands, and Springs and Seeps: Riparian areas and wetland ecosystems associated with lakes, streams, rivers, springs, and seeps are highly important habitats to numerous wildlife species and are utilized disproportionately (more than their availability). In Colorado, it is estimated that at least 40% of vertebrate species are closely associated with riparian habitats (Hoover and Wills 1984). These species include approximately 70% of the breeding birds in Colorado, as well as big game species, small mammals, furbearers, and a variety of other non-game species. In Colorado, 82% of nesting bird species occur in riparian habitats (Schultz 1991) and 50% or more may be dependent on riparian vegetation for breeding (Yanishevsky and Petring-Rupp 1998). Riparian areas, wetlands, springs, and seep habitats occupy only 2.1% of the planning area. Although

small in acreage, the health and condition of these habitats is critical to the overall maintenance of biodiversity, especially in arid to semiarid landscapes.

The presence of surface water most of the year is the key physical characteristic of riparian areas, wetlands, springs, and seeps. More abundant surface water supports vegetation that is often more lush, productive, complex, and structurally diverse than surrounding upland habitats. This greater productivity and ecosystem diversity in turn provides more abundant food and cover resources for insects, small mammals, and migratory birds (Yanishevsky and Petring-Rupp 1998). For this reason, streamside riparian habitats provide very important corridors for migrating birds.

Urbanization, agriculture, the construction of dams and reservoirs, and water diversions has created long-term impacts to riparian areas, wetlands, springs, and seeps on the SJNF and TRFO over the past 100 years. Past management activities on SJNF and TRFO, including timber harvest, mechanical fuels treatments, oil and gas development, livestock grazing, recreation, prescribed fire, utility corridor construction, and solid minerals development have also impacted these habitats on the SJNF and TRFO. Many past impacts were minor and short-term that have since recovered due to reclamation efforts and natural processes. Other past impacts are still evident and would remain evident over the next 15 years. Of particular importance to migratory birds, continuing past impacts to riparian areas and wetlands include fewer willows (*Salix* sp.) and cottonwood (*Populus* sp.) trees in deciduous riparian forests, fewer willows in deciduous riparian shrublands, and fewer sedges (*Carex* sp.) and rushes (*Juncus* sp.) in riparian area and wetland herbaceous types. Tamarisk (*Tamarix* sp.), an exotic invasive shrub, has become established in many lower-elevation riparian areas of the SJNF and TRFO where it competes with and has in some cases replaced native cottonwoods and willows. There is concern that tamarisk may provide lower quality habitat for breeding birds because tamarisk supports fewer breeding species and fewer individuals, but the impact of tamarisk use on bird productivity or survivorship has not been well documented (Sogge et al. 2008).

With a changing climate, the observed temperature record in southwest Colorado shows average annual warming of about 2 degrees Fahrenheit over the last 30 years (Western Water Assessment 2007). Increasing stream temperatures and hydrologic changes such as reduced late season base flows may reduce the amount and condition of riparian and wetland vegetation, thereby reducing habitat capability for wildlife species associated with riparian areas and wetlands. Lack of, or decreased, stream flow has resulted in impacts to aquatic species and associated wetlands and riparian areas. Decreased stream flows and decreased inputs for springs and seeps could further reduce the condition and amount of streamside riparian, wetland, spring, and seep habitats, further reducing the habitat capability for wildlife species closely associated with water-dependent features.

Improved management practices such as livestock grazing over the past 20 years have generally improved ecological conditions of riparian areas, wetlands, and spring and seep habitats on the SJNF and TRFO. Declines, however, in water quantity and quality associated with prolonged drought and increased human uses are expected to continue, and declines in wildlife habitat capability of water-dependent features may therefore be expected to occur.

A wildlife management challenge is to maintain or improve habitat capability for wildlife species closely associated with riparian areas, wetlands, and spring and seep habitats. Where surveys have been conducted within the planning area, the current trends (past 15 years) for aquatic habitats are decreasing, and therefore the current trends for associated riparian areas, wetlands, springs, and seeps are also likely decreasing. The combined stress of reduced stream flows, higher water temperatures, and poorer water quality have decreased the amount and capability of riparian areas and wetlands from historic levels. With drought continuing in southwest Colorado, the amount and capability of riparian areas, wetlands, and spring and seep habitats are expected to also decline into

the future. Declines in habitat conditions and capability for resident and migratory bird species closely associated with riparian areas, wetlands, springs, and seeps is expected to continue for the foreseeable future. Bird species for which there is management concern that are closely associated with riparian areas, wetlands, springs, and seeps include northern harrier, Lewis's woodpecker, short-eared owl (*Asio flammeus*), southwestern willow flycatcher and yellow-billed cuckoo (*Coccyzus americanus*).

In response to this management challenge and wildlife habitat improvement opportunity, standards and guidelines were developed in Volume II, LRMP (see sections on riparian area and wetland ecosystems, aquatic ecosystems, and water) to maintain and improve water quantity, water quality, and hydrologic function of surface water and associated water-dependent features.

Mammals

There are numerous mammal species that utilize all terrestrial habitats within the planning area. Generally, mammals are categorized as groups such as big game and other game species, furbearers and carnivores, small to medium-sized mammals, and specialized mammal groups such as bats. Some mammal species are generally common and well distributed across the planning area, while other mammal species are less common and/or with limited distribution in the planning area. Some species such as deer mouse and black bear are generalist species that occur in a wide variety of habitats, while other species, such as southern red-backed vole and American marten, are associated primarily with distinct habitat types and/or vegetative successional stages. Specialized mammal species (such as bats) may only reproduce in unique habitat features (such as caves, rock crevices, and/or specific age classes of snags) that are relatively rare in the planning area.

The primary big game species that are hunted within the planning area are Rocky Mountain elk and mule deer. To a lesser degree, moose, black bear, bighorn sheep (Rocky Mountain and desert subspecies), mountain goat, and mountain lion are also hunted as big game species. Other game species include dusky grouse, Merriam's turkey, mourning dove, band-tailed pigeon, ring-necked pheasant, cottontail (mountain and desert species), and various species of waterfowl.

The planning area provides both summer and winter range, supporting the population objectives for deer and elk as established by CPW. Most of the elk and deer summer range occurs on the SJNF portion of the planning area, while most winter range occurs at lower elevations on mixed ownerships (including SJNF, TRFO, state-administered lands, private lands, and tribal lands). CPW tracks the status of game species in the state across all land ownerships, including on SJNF and TRFO, consistent with their responsibilities for setting ungulate herd size objectives and regulating the hunting of game species.

As with most of Colorado, elk numbers within the planning area increased substantially from the early 1980s through the late 1990s. Currently, elk populations are fluctuating within CPW population objectives. The CPW has used research and modeling methods to estimate elk abundance and has revised herd management plans to account for previously under-estimated populations. The population objective revisions and liberal cow elk harvests have aligned populations and population objectives at levels that are supported by existing habitat. As of 2011, the estimated post-hunt population for the three elk herds on the SJNF and TRFO was approximately 42,400 elk, which is within the long-term population objective range of 39,000 to 46,000. Most elk utilize the large amount of summer range that is available within the planning area and then migrate to mixed-ownership winter range at lower elevations.

There is concern with maintaining or improving the quality of winter range on public lands to help reduce conflicts on private lands as land uses change over time. As with much of the western United States, however, mule deer numbers in Colorado have generally decreased since their population highs of the 1950s and 1960s (Mule Deer Working Group 2003). Within the planning area, mule deer numbers have declined during the past 30 years. As of 2011, the estimated post-hunt population for the four deer herds on the SJNF and TRFO was approximately 57,600 deer, which is less than the long-term population objective of 76,000.

Carnivores and furbearers constitute another group of mammals that are of public interest and could be influenced by various program areas and management activities. Most carnivores and furbearers are of high economic and aesthetic value to the public, and of high ecological value. This is due to their role in the food chain and their place as keystone species in maintaining other ecological functions (such as beaver and their ecological value to wetlands and riparian systems). This group contains a wide variety of species that inhabit water bodies, stream and riverine systems, grasslands, and various coniferous forest and other vegetative systems. Species of local interest include beaver (*Castor* sp.), river otter (*Lontra canadensis*), mink (*Mustela* sp.), badger, skunk (Mephitidae), muskrat (*Ondatra zibethicus*), ring-tailed cat (*Bassariscus astutus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), black bear, mountain lion, bobcat (*Lynx rufus*), Canada lynx, American marten, red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), and weasel (*Mustela* sp.) species. The furbearer and carnivore group includes one federally listed species (Canada lynx), as well as several species that have been most likely extirpated from the planning area (grizzly bear [*Ursus arctos horribilis*], wolf [*Canis lupis*], black-footed ferret [*Mustela nigripes*], and perhaps wolverine). The pursuit of furbearers declined when most trapping became illegal in Colorado in 1996. However, legal methods of take (including live traps) are currently allowed for certain species. The pursuit of furbearers (including beaver, muskrat, bobcat, coyote, red fox, and badger) is a valued activity by a small segment of the population.

There are numerous small to medium-sized mammals found throughout the planning area. Small to medium-sized mammals include mice, voles, gophers, carnivore, and furbearer species mentioned previously, among others. Small to medium-sized mammals are found across many of the habitat types present in the planning area. Many species use a wide variety of habitat types, while some species are restricted to a narrow range of habitat types, such as Abert's squirrel and its dependence on mature stages of ponderosa pine forests. Populations of small to medium-sized mammals can be influenced by management actions, while other small mammal populations are influenced predominately by weather and other natural disturbances (fire, insects, and disease).

Currently, there are at least 16 species of bats that occur on, or near, the planning area, and they occur in nearly every ecological zone available. Structures and habitat types that are especially important to most bat species include caves, mines, rock outcroppings and crevices, large-diameter standing snags, old buildings, water sources, riparian zones, and the pinyon-juniper habitat type.

<u>Wildlife Analysis Issues Related to Mammals</u>

Disturbance and Big Game Habitat Effectiveness: The population changes in Archuleta, Dolores, La Plata, and Montezuma Counties is indicative of the growth rate around the SJNF and TRFO. From 2000 through 2010, these four counties grew by approximately 12%. The U.S. growth projection for the year 2025 is 11% (U.S. Census Bureau 2010a). This population growth has been fueling a recreation boom that utilizes expanding technological advances in motorized recreation devices, as well as a growing array of non-motorized recreational pursuits that are expanding their influence across the landscape. Increased demand for recreational opportunities is expected to continue for the foreseeable future. The growing human population, technological advances in recreational

equipment, and development of new forms of recreation has expanded human activity into a variety of wildlife habitats and into previously secure habitat areas, including areas where direct human influences were previously minor or absent. This trend during the past 30 years of increased overall human presence and activity is expected to continue and likely increase for the foreseeable future. As a consequence, the amount, condition, and effectiveness of some key wildlife habitats are expected to decline for the foreseeable future.

It is estimated that the planning area currently supports approximately 1.9 million visitor days per year. The visitor days include an array of summer uses, as well as several winter recreational pursuits. In both seasons, the activities involve motorized uses (all-terrain vehicles [ATVs] and snowmobiles) and non-motorized uses (skiing, snowshoeing, hiking, hunting, and wildlife watching). Based on the projected population growth, the USFS and BLM assume that many types of recreational activities have the potential to substantially increase and expand over the life of the LRMP. Some types of activities are based on the desire for personal challenges and competition, and thus require space, challenging terrain, and/or scenery. Over the past 30 years, these and other pursuits have expanded into previously undisturbed areas, causing a gradual decline in wildlife habitat effectiveness in some areas and for some species of mammals.

Over the duration of the current LRMP, the number of recreation users and variety of recreational activities have expanded substantially in numbers of users and into previously less disturbed areas such as designated wilderness and other backcountry areas. These areas serve a vital role in providing seclusion habitat for wildlife. The expansion of recreation trail networks, and increasing numbers of users on existing trail networks, have resulted in gradual declines in wildlife habitat effectiveness around existing trail networks, especially on public lands in close proximity to local communities where trail networks have continued to be expanded and new networks developed. These trail systems have fragmented limited critical habitats (e.g., winter range) and increased human disturbance in former security areas during times of year when animals are grouped, stressed (e.g., winter), and when food is most scarce. The combined effects of these factors leave animals more vulnerable to disturbance-induced declines in body condition and/or direct mortality. These trends of increasing numbers of recreational users of existing infrastructure, diversifying types of recreational activities expanding into previously less disturbed areas and increasing demand for motorized and non-motorized recreational opportunities are expected to continue for the foreseeable future across all LRMP alternatives.

Other forms of human disturbance, in addition to recreation, have also increased substantially over the past 30 years. During this time, some portions of the SJNF and TRFO have seen expansions of road and motorized trail networks for the development, operation and maintenance of leasable minerals, extraction of timber and other forest products, and providing motorized recreational opportunities.

Elk and mule deer occupy a variety of habitat types during the spring, summer, and fall seasons. Much of the SJNF and the Silverton portion of the TRFO provide spring, summer, and fall ranges for elk and deer. The western portions of TRFO lands, which are lower elevation and generally drier, are used much less by elk and deer during these seasons. During the winter, however, elk and deer become concentrated on lower-elevation ranges (usually below 8,000 feet, although the upper-elevation limit fluctuates depending on seasonal snow depth). In contrast to their distribution during snow-free seasons, during winter elk and deer use only relatively small portions of the SJNF, but they use most of the lower-elevation portions of the TRFO. Much of the winter range that elk and deer depend on occurs as a mosaic of land ownerships (including the SJNF and TRFO, the Southern Ute Indian Tribe, the State of Colorado, and private lands). On private land, development and population

growth has reduced the availability and capability of traditional winter range areas, particularly near the urban centers. Roads and other infrastructure have further dissected the available habitat and/or reduced the effectiveness of former security areas.

Maintaining effective winter range is considered critical to the maintenance of big game populations. Over the past 30 years, some portions of the SJNF and TRFO have seen declines in the number of big game animals using known wintering areas. Gradual downward trends in habitat capability or effectiveness of some portions of the SJNF and TRFO are expected to continue for the foreseeable future. The mammal habitat areas on the SJNF and TRFO that have been most affected by long-term continued increases in human activities and disturbance and thus continued downward trends in wildlife habitat effectiveness are big game wintering ranges and parturition areas for species such as elk, deer, and bighorn sheep. On the SJNF and in some cases on the TRFO, these areas can be relatively small in total area, have relatively large numbers of animals condensed into relatively small areas, and are used by animals at times of year when weather conditions are often harsh and body condition of animals is in decline or low. For all these reasons, some areas of the SJNF and TRFO have seen reduced numbers of animals in key habitat areas. Human disturbance impacts are expected to continue to increase for the foreseeable future.

It is believed, however, that although human disturbance has caused declines in the capability and effectiveness of some wildlife habitat areas, nowhere on the SJNF and TRFO is human disturbance thought to be limiting animal populations. At this time, big game animal populations are thought to be limited primarily by the combined effects of hunter harvest, winter mortality, and other mortality sources. For this reason, at present, habitat conditions on the SJNF and TRFO are believed to be capable of supporting the numbers of animals sufficient to meet the State of Colorado’s population objectives for big game species. It is also believed, however, that if declining trends in habitat effectiveness continue in some big game winter ranges, the amount and condition of wintering habitats may become a factor that could limit the ability of the SJNF and TRFO to support State of Colorado big game population objectives in the future. In response to these concerns, LRMP components were developed that address big game habitat effectiveness and capability, especially for winter ranges and parturition areas. The coexistence of wildlife with a growing human population that values a diversity of recreational pursuits and the utilization of public land resources would require continued planning and management.

Physical Fragmentation of Key Wildlife Habitats: Roadless areas are recognized for the high amount of biological integrity they provide within a landscape matrix that is increasingly influenced by human disturbances and habitat fragmentation (Pearson et al. 2003). Roads are one of the most pervasive impacts of human development on wildlife and their greatest impact is the indirect effects of habitat fragmentation and avoidance by wildlife (Hebblewhite 2008; Lyon and Christensen 2002). In the southern Rocky Mountains, roads may represent the most substantial long-term impact related to humans and may potentially affect many of the ecological processes that create and maintain biological diversity (McGarigal et al. 2001). From a wildlife perspective, roadless areas provide larger landscapes that are relatively less disturbed by human development and activities, are important as refugia or source areas for some wildlife species that naturally occur at relatively low densities, provide blocks of source habitats for species thought to be “area-sensitive,” and are crucial to the long-term survival of many species-at-risk (Payne and Copes 1988; Robinson 1992a, 1992b; USFS 2001). Once these landscapes are roaded, the value for wildlife often decreases as fragmentation and associated impacts occur (Lyon 1983; Lyon and Christensen 2002; Miller et al. 1996).

CRAs occur on approximately 566,000 acres of the USFS portion of the planning area. In general, most CRAs are located in higher elevations and habitats. Maintenance of CRAs continues to be

important to the public and continues to provide important wildlife habitat values that are not attainable to such an extent elsewhere within the planning area.

Ecosystems in the southern Rocky Mountains are naturally fragmented by steep terrain and large ranges of elevation, aspect, and moisture regimes (Preston and Kingery 1998). Many mammals are adapted to using broad ranges of habitats and/or moving across large distances to take advantage of widely dispersed preferred habitats whose availability varies by season of the year. Many species, however, prefer larger blocks of relatively intact habitat in which to forage, rest, and feed. Species such as American marten and southern red-backed vole are most abundant in the largest available patches of mature spruce-fir forests (Buskirk and Ruggiero 1994; Hayward 1994; Knight 1994). As larger blocks of habitat have become more fragmented by road, motorized trail and utility corridors, access ROWs, vegetation management projects, and mineral development, the capability of wildlife habitats that surround those project areas has also declined, especially for habitats that are naturally limited in extent by topography or vegetation, such as winter ranges, parturition areas, and wildlife travel corridors. At present, the USFS and BLM do not believe that wildlife habitat conditions on the SJNF and TRFO have declined to the point where habitat capability is the dominant factor limiting wildlife populations. It is possible, however, that the combined effects of multiple activities and projects could, over time, increase to an extent that habitat conditions could become a substantial factor limiting numbers or distribution of some wildlife populations on the SJNF and TRFO. There is potential for habitat conditions in key wildlife habitats to decline such that habitat conditions could limit the ability of those habitats to sustain wildlife populations sufficient to meet the State of Colorado's population objectives for some herds of deer and elk. In response to this management challenge, a variety of standards and guidelines were developed to maintain or improve habitat conditions in key wildlife habitat areas such as big game winter ranges and parturition areas mapped by CPW and wildlife travel corridors.

Improve the Amount (NFS lands) and Condition (BLM and NFS lands) of Sagebrush Shrubland Habitats: Historically the amount of sagebrush habitats were reduced on the SJNF and TRFO, and the conditions of sagebrush stands were altered by projects intended to increase/improve livestock forage using both mechanical means such as chaining and root plowing and by chemical means such as spike. These activities resulted in declines in the amount and abundance of sagebrush shrublands on some portions of the SJNF and TRFO and degraded habitat conditions within stands that remained. Long periods of intensive livestock grazing and periods of extended drought reduced the species diversity and abundance of native grasses and forbs in the sagebrush understory, further reducing their value for wildlife habitat. Invasion and colonization of sagebrush stands by pinyon pine, juniper trees and invasive plant species has continued to gradually alter sagebrush shrublands on the SJNF and TRFO and reduce its capability for supporting expected abundance and diversity of sage-associated wildlife species. Wildlife species most closely associated with sagebrush shrublands on the SJNF and TRFO include mule deer (primarily during winter), antelope, Gunnison sage-grouse, sage sparrow, and Brewer's sparrow.

There are only limited amounts of sagebrush shrublands on NFS lands, mostly in relatively small and isolated stands associated with pinyon-juniper woodlands and mixed mountain shrublands. Most sagebrush shrublands on NFS lands are in poor and highly modified condition. Some of the highest densities of mule deer that winter on NFS lands are in association with and dependent upon sagebrush shrublands. In contrast, on BLM lands there are large and contiguous expanses of sagebrush shrublands. Sagebrush shrublands on BLM lands also provide high value deer winter range, and in some areas wintering animals reach high densities. LRMP direction was developed to maintain or improve habitat conditions in sagebrush shrublands, especially in key wildlife habitat areas such as deer winter ranges and Gunnison sage-grouse habitat areas.

Maintain or Improve Habitat Conditions and Movement Opportunities within Wildlife Travel Corridors: A wildlife management challenge is maintaining wildlife movement corridors, particularly for landscape connectivity for big game animals that must move between low-elevation wintering areas and generally higher-elevation summer areas, and for Canada lynx and other large carnivores. Maintaining movement opportunities across state and federal highways is very important, and large numbers of deer and elk are killed each year attempting to cross highways. Roads constitute one of the greatest potential impacts to landscape connectivity and maintenance of biodiversity (Hebblewhite 2008). For example, roads that cross the SJNF and TRFO have resulted in direct mortality of individuals, substantial habitat loss, barriers to dispersal, altered behavior and habitat use of individuals, and habitat modification (including increased edge habitat and exotic species introductions) (McGarigal et al. 2001; Trombulak and Frissell 2000). All of these effects have been observed, to varying degrees, on the SJNF and TRFO over the past 15 to 20 years. There is potential for these effects to continue or increase during the next 15 to 20 years. In most cases, federal highways and primary use roads amplify these impacts due to high traffic volume and traffic characteristics. The design of movement corridors or landscape linkages is accepted as a primary means of maintaining connectivity (Noss and Harris 1989; Rosenberg et al. 1997).

The primary ecological rationale for travel corridors in wildlife conservation is to increase population persistence by allowing the continued exchange of individuals among previously connected populations (Peck 1998; Rosenberg et al. 1997). This is important for certain species, and needs vary from species to species. For example forest carnivores such as Canada lynx generally have large territories. Lynx utilize areas of connected habitat within their home range and for dispersal across large landscape areas (Ruediger et al. 2000). In another example, species such as deer and elk with migratory patterns connecting far removed summer and winter ranges have found busy highways in certain areas as obstacles to free movement with results that vary from high vehicle collision mortalities to totally impeding seasonal movements (Heffelfinger 2006). Due to the naturally fragmented nature of the southern Rocky Mountain landscapes (Preston and Kingery 1998), there are inherently important natural topographic and vegetation features that link disconnected patches of primary habitat and promote movement and habitat connectivity (Ruediger et al. 2000). Ridgelines, drainages, and saddles are examples of topographic features that are inherently important for wildlife movement.

Recent studies of radio-collared mule deer movements have documented several high use highway crossing areas on the SJNF and TRFO as deer migrate from lower-elevation winter areas to higher-elevation summer areas (Johnson 2008). The areas identified as high use wildlife travel corridors are also areas that have been well known for high historic rates of wildlife/vehicle collisions. The lands managed by the SJNF and TRFO that lie within and adjacent to these high use wildlife travel corridors also have a variety of multiple use management activities occurring within them, such as mineral development, fuels reduction projects, timber harvest projects, livestock grazing, and motorized recreation. A management challenge facing the SJNF and TRFO is to continue to identify areas important for wildlife population connectivity and highway crossings, and to maintain or improve connectivity across human-made barriers to facilitate safe movement of animals along historical seasonal travel corridors.

In response to this continuing management challenge, a variety of standards and guidelines were developed to maintain or improve habitat conditions and movement opportunities within important wildlife travel corridors to maintain or improve movement of animals between seasonal ranges. This would maintain or improve connectivity of wildlife populations across large landscapes, especially in key wildlife habitat areas such as deer and elk winter ranges mapped by CPW, as well as mapped Canada lynx landscape linkage areas.

Threatened and Endangered Species

Species that are listed as threatened or endangered under the ESA, or are proposed or candidates for such listing, are of particular conservation concern to the SJNF and TRFO because of their status and need for special management attention. By definition, a species listed or proposed for listing under the ESA is a species for which the local administrative unit would have concern for sustaining existing populations, suitable habitats, or non-breeding occurrences, thereby contributing to conservation of the species' across its range. Species listed as threatened, endangered, or proposed fall under the purview of Section 7 of the ESA (16 USC 1531 et seq.), which outlines the procedures for federal interagency cooperation designed to conserve federally listed species and designated critical habitats. Section 7(a)(2) of the ESA states that any action authorized, funded, or carried out by a federal agency would not likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. A list of federally listed species for the SJNF and TRFO was received from the USFWS on December 21, 2012.

The SJNF and TRFO have long histories of interagency cooperation and consultation with the USFWS, with the goal of conserving and restoring federally listed species. Federally listed species, as well as other local species of concern or interest, would remain a management priority within the planning area.

Currently there are four federally listed terrestrial species that occur or have habitat present in the planning area (Table 3.3.2). Of these four species, two are listed as endangered (southwestern willow flycatcher and Uncompahgre fritillary butterfly) and two are listed as threatened (Canada lynx and Mexican spotted owl). All four species are known to occur on the SJNF and one is known to occur on the TRFO. None of these four listed species has critical habitat designated on the SJNF or TRFO. There are two species proposed for listing under the ESA that have habitats available on the SJNF and TRFO. Gunnison sage-grouse is proposed for listing as endangered and small populations occur on the west and northwest portions of the planning area. The listing package also proposes to list some habitat areas on the SJNF and TRFO as critical habitat for Gunnison sage-grouse. North American wolverine is proposed for listing as threatened under the ESA. The species is not known to exist in the planning area and is thought to have been extirpated from the state of Colorado in the early 1900s, but habitats thought to be suitable for wolverine are found across the planning area in the form of alpine basins and subalpine forests. The southwestern willow flycatcher and wolverine are also listed as endangered by the State of Colorado, the Canada lynx and Mexican spotted owl are also listed as threatened by the State of Colorado, and the Gunnison sage-grouse is designated a state special concern species in the state.

Southwestern willow flycatcher, Mexican spotted owl, and Uncompahgre fritillary butterfly are confirmed to occur in only one location each on the SJNF. There are no confirmed occurrences of these three species on the TRFO. Canada lynx has been documented to occur across most of the higher-elevation spruce-fir forests of the SJNF and TRFO. The amount and condition of habitat suitable for all four federally listed species has remained stable across the SJNF over the past 20 years (comparable data for TRFO lands is not available). The population trend for Uncompahgre fritillary butterfly at the single known occupied site (on the SJNF) is considered to be stable. Each single location where southwestern willow flycatcher and Mexican spotted owl have occurred (on the SJNF) has been only irregularly occupied by non-breeding individuals. For this reason, no populations of Mexican spotted owl or southwestern willow flycatcher are known in the planning area, and therefore no population trend can be calculated for these species. In contrast, Canada lynx populations on the SJNF and TRFO are believed to have increased substantially, due in large measure to a multi-year reintroduction program conducted by CPW. Two small populations of

Gunnison sage-grouse are known to occur on BLM lands in the west and northwest portions of the TRFO, but birds are not known to occur on the SJNF.

Table 3.3.2: Federally Listed Terrestrial Wildlife Species on the SJNF and TRFO

Species	Federal Listing Category	Primary Habitat Association	General Habitat and Status
Canada lynx (*Lynx canadensis*)	Threatened	Spruce-fir	Primarily inhabits high-elevation spruce-fir forests; also cool-moist mixed conifer, high-elevation aspen mixed with spruce or cool-moist mixed conifer, and willow-riparian adjacent to the above habitats. Closely associated with snowshoe hare as a primary prey item. The planning area is considered part of the core habitat for the state lynx reintroduction program.
Mexican spotted owl (Strix occidentalis lucida)	Threatened	Pinyon-juniper/mixed conifer	Mixed conifer or ponderosa pine/mixed conifer located in steep rock-walled canyons. Individuals have been documented on the SJNF but not TRFO; no documented reproduction to date.
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Endangered	Riparian/ Wetland	Willow-riparian patches of at least 30 × 30 × 5 feet, and at least 0.25 acre or larger. Individuals have been documented on the SJNF but not TRFO; no documented reproduction to date.
Uncompahgre fritillary butterfly (*Boloria acrocnema*)	Endangered	Alpine	Alpine habitat above 13,000 feet with a snow willow component. Sites are generally found on north, northeast, and east aspects and represent the coolest microclimates in high alpine cirques. One small population is known to occur on the SJNF, but not TRFO.
Gunnison sage-grouse (*Centrocercus minimus*)	Proposed Endangered with Proposed Critical Habitat	Sagebrush shrublands	Occupied habitat as mapped by CPW; known to occur on the TRFO but not SJNF.
North American wolverine (*Gulo gulo*)	Proposed Threatened	Alpine, and subalpine forests	Alpine and tundra habitats and adjacent boreal/subalpine forests; also alpine cirque basins, avalanche chutes, rough mountainous terrain with deep snow lasting late in spring. The SJNF and TRFO are thought to provide extensive suitable habitats. No confirmed occurrences in recent decades.

Within the planning area, management activities may impact these four federally listed species and two proposed species, and/or their suitable habitats. Activities that could cause impacts to Canada lynx are evaluated based on the 2008 Southern Rockies Lynx Amendment (SRLA) (USFS 2008b), an amendment to the San Juan National Forest Land and Resource Management Plan. This amendment provides objectives, standards, and guidelines as management direction for projects on NFS lands that may impact lynx or their habitat. The amendment does not apply to projects on BLM lands. Projects on BLM lands are guided by direction in the Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000), and the Inter-Agency Southern Rockies Lynx Project Decision Screens (USFS 2010a).

Conservation actions for the Mexican spotted owl, southwestern willow flycatcher, and Uncompahgre fritillary butterfly are guided by their respective USFWS recovery plans. As a result, consultation with the USFWS is frequently required for project-level activities within the planning area under Section 7(c) of the ESA. BMPs and mitigation measures have been, and would continue to be, implemented in order to minimize impacts to the habitats on which these species depend. Conservation actions for Gunnison sage-grouse would be guided by the Gunnison sage-grouse Rangewide Conservation Plan (Gunnison Sage-Grouse Rangewide Steering Committee 2005). Conferencing with the USFWS on effects to sage-grouse may be necessary for some projects. Conferencing with the USFWS on effects to wolverine is thought to be unlikely at this time because no populations are known to exist in Colorado.

Two additional terrestrial species are listed as candidates for federal listing, New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) and yellow-billed cuckoo. Candidate species are managed as sensitive species under BLM and USFS policy. Under USFS policy, effects to sensitive species are assessed through the Biological Evaluation process to assure that best conservation practices are applied at the project level. Under BLM policy, effects to sensitive species are assessed at the project level during the NEPA process. For both agencies, assessments are made at the project level for suitable habitat of candidate species and possible occurrence in or near project areas.

<u>Canada Lynx</u>

In March 2000, the Canada lynx was listed as a federally threatened species under the ESA. In March 2009, the USFWS revised the critical habitat designated for lynx to include approximately 39,000 square miles encompassing five critical habitat units in Maine, Minnesota, Montana, Wyoming, Idaho, and Washington.

The planning area represents the southern edge of the historic range of the Canada lynx. Individual lynx, or population groups, have been extremely rare or absent within the planning area and across Colorado since the early 1900s. In 1999, the CPW initiated a lynx recovery program intended to augment any existing populations in the southern Rocky Mountains with transplants from Canada and Alaska. The augmentation program resulted in 218 lynx being transplanted into the San Juan Mountains between 1999 and 2006. Habitat on USFS and BLM lands within the planning area have contributed to the reintroduction effort and are considered part of a core area that is important to recovery of lynx in Colorado. From February 1999 to February 2005, 144 of the reintroduced lynx were detected in the planning area and 126 kittens were born in Colorado as of June 2009.

In the southern Rocky Mountains, high-elevation spruce-fir forests make up the primary habitat for lynx and its primary prey species, the snowshoe hare. There are approximately 777,000 acres of lynx habitat on NFS lands and approximately 15,000 acres of lynx habitat on BLM lands in the planning area.

Currently, there is no federal recovery plan published for this species. NFS lands are managed under the guiding requirements of the SRLA and LCAS (Ruediger et al. 2000, revised in 2006 [USFS and USFWS 2006]). On BLM lands, Canada lynx habitat is managed according to the Canada Lynx Conservation Agreement, which was signed by the USFS, BLM, and USFWS in the spring of 2000 (USFS and USFWS 2000). Under that agreement, the land management agencies agreed to consider the recommendations contained in the LCAS in order to help guide planning activities and ESA Section 7 consultation. These guiding documents include habitat definitions, recommended analysis methods, and conservation measures, goals, objectives, standards, and guidelines intended to help provide a consistent approach to conserve Canada lynx in the conterminous United States.

Mexican Spotted Owl

The Mexican spotted owl is one of three subspecies of spotted owl in North America. In March 1993, the Mexican subspecies was listed as a federally threatened species under the ESA. The proposed rule to designate critical habitat for the Mexican spotted owl was completed by the USFWS in February 2001. That proposal included 4.6 million acres across Colorado, Utah, Arizona, and New Mexico. The 2001 proposal was considered inadequate by the courts in October 2003, and a new final rule to designate critical habitat was published in August 2004. The 2004 rule included 8.6 million acres across federal lands in Colorado, Utah, Arizona, and New Mexico. Approximately 322,326 acres (approximately 3.7%) of this land occurs in Colorado. The planning area was not included in the 2001 or the 2004 critical habitat designations.

There have been numerous Mexican spotted owl surveys conducted across the SJNF and TRFO since the late 1980s. To date, protocol surveys have detected only three Mexican spotted owls on NFS lands (two juvenile females and one juvenile male). These detections occurred during separate years in the southeastern portion of the planning area. These detections may represent individuals that occasionally disperse and/or move to and from more suitable habitat to the south. There have been no Mexican spotted owl detections on BLM lands in the planning area. Nesting has been documented in Mesa Verde National Park, but no owls have been located outside the park on adjacent BLM-administered or NFS lands. The occurrence of Mexican spotted owl within the planning area appears to be irregular and uncommon, and similar to other locations in Colorado where apparently suitable habitat remains unoccupied.

Mexican spotted owl habitat was mapped across the planning area in 1992. A total of 67,324 acres of habitat in 31 locations were mapped along the southern boundary of the planning area. These areas represent approximately 2% of the total acreage in the planning area. Habitat for Mexican spotted owl would be re-evaluated as the current Mexican Spotted Owl Recovery Plan (USFWS 1995) is updated and available (USFWS 2012c).

Mexican spotted owl habitat in the planning area occurs mostly in steep, narrow, rocky canyons that are rarely subject to management activities; therefore, habitat has been minimally affected by management actions. Habitat present across most areas has been influenced by insects, disease, and wildfire. These disturbance processes have reduced habitat quality over the last 20 years. Management activities (mechanical fuels reduction, prescribed fire, forest restoration projects) have been completed in some locations to help restore habitat conditions and reduce the risk of catastrophic wildfire. Management of Mexican spotted owl habitat across the planning area has been consistent with the current recovery plan, and would continue as that recovery plan is updated. Continued inventory and monitoring of suitable habitat and maintenance of occupied habitat would be the primary conservation measures that the SJNF and TRFO would use in order to aid in the recovery of the species.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is one of four or five recognized subspecies of the willow flycatcher (Sedgwick 2001). In March 1995, the southwestern willow flycatcher was listed as a federally endangered species under the ESA. The proposed rule to designate critical habitat for the southwestern willow flycatcher was completed in October 2004. The proposal included 1,556 floodplain miles in California, Arizona, Nevada, Utah, Colorado, and New Mexico as critical habitat within the 100-year floodplain or flood-prone areas. The proposal also identified the essential stream and lake edge habitats thought to be essential for conserving the species (USFWS 2004). There is no designated critical habitat for the southwestern willow flycatcher in the planning area.

The current survey information indicates that southwestern willow flycatchers are localized and uncommon on the SJNF. There are no confirmed breeding populations of southwestern willow flycatcher in the planning area. Increasing trends in overall riparian habitat conditions suggest that ample unoccupied habitat is available if the subspecies eventually begins nesting within the planning area.

In summary, the current information suggests that the planning area does not measurably contribute to the recovery or overall viability of the southwestern willow flycatcher. The possibility of future individual breeding pairs, however, cannot be discounted as the recovery of the subspecies expands. Continued monitoring of suitable and occupied habitats would continue to utilize the USFWS protocol. Management of southwestern willow flycatcher habitat across the planning area has been consistent with the current Southwestern Willow Flycatcher Recovery Plan (USFWS 2002a) and would continue as the recovery plan is updated. Continued inventory and monitoring of suitable habitat and maintenance of occupied habitats would occur in order to aid in the recovery of the species.

Uncompahgre Fritillary Butterfly

The Uncompahgre fritillary butterfly was discovered in 1978 and described as a new species in 1980. In 1991, it was listed as a federally endangered species. The Uncompahgre fritillary butterfly has the smallest range of any North American butterfly and is restricted to alpine, snow willow habitats within a small geographical area in the San Juan Mountains and southern Sawatch Range in southwest Colorado. Suitable habitat in the planning area occurs on both BLM-administered and NFS lands.

Suitable habitat for the Uncompahgre fritillary butterfly is restricted to topographic features that rarely occur in the planning area. Suitable habitat consists of snow willow above 13,000 feet on north, northeast, and east aspects. Snow willow serves as the host plant for the eggs and larvae of the Uncompahgre fritillary butterfly. Most of the snow willow patches in the planning area do not support the vegetative characteristics of occupied sites found on neighboring forests (may be related to soil and moisture factors).

Since 1983, the number of known Uncompahgre fritillary butterfly colonies across the species range has increased (as more extensive surveys have been initiated). Currently, the species is known, or suspected, to occur at 12 sites, all of which contain various numbers of population clusters. After at least 9 years of intensive inventory, all probable locations for finding additional Uncompahgre fritillary butterfly colonies are nearly exhausted. There are no additional priority sites to survey within the planning area that may possibly support the species (although one additional site on SJNF land is considered a possibility, if snow willow characteristics are adequate).

The Uncompahgre fritillary butterfly was not known to occur in the planning area until 2004, when a small habitat patch associated with an existing colony was discovered on SJNF lands. There are no threats identified for this colony (due to its remoteness), and habitat has remained stable. Current monitoring shows the population is persistent, and the entire colony currently remains one of the most extensive of the known populations (Ellingson 2003).

Currently, there are enough known colonies of sufficient size to down-list the Uncompahgre fritillary butterfly. However, the down-listing criteria calls for 10 stable colonies for a period of 10 years, and not enough colonies have been known for the time specified. There is also a need for more long-term monitoring in order to determine population changes over time. Due to their seclusion, there are few, if any, immediate risks or management issues associated with the colonies. Continued monitoring and confidentiality of colony locations are the primary conservation measures pursued for the species.

Gunnison Sage-grouse

The Gunnison sage-grouse is proposed for listing as endangered under the ESA, and critical habitat has been proposed in the planning area.

Gunnison sage-grouse currently occupy a small fraction of their historical range and have been extirpated from much of their presumed historical distribution due to habitat conversion (Gunnison Sage-grouse Rangewide Steering Committee 2005). Although their distribution was probably always somewhat fragmented, the amount of fragmentation has greatly increased due to habitat loss. As of 2004, the total population of this species was estimated at approximately 3,200 breeding birds in seven populations (75% of which occurred in the Gunnison Basin). In 2011 CPW estimated Gunnison sage-grouse populations to be 4,155 breeding birds. The Gunnison sage-grouse remains a species of conservation interest in this planning process because two small populations (Dove Creek and San Miguel) occur on lands administered by the TRFO and because of continued habitat and population viability concerns. The Dove Creek and San Miguel populations are not thought to contribute to the overall viability of Gunnison sage-grouse range wide. Dove Creek supports 1.4% of the total Gunnison sage-grouse population and San Miguel supports 2.2% of the total population. Two subpopulations (Dry Creek and Miramonte) within the San Miguel population occur on the TRFO.

There are many threats and challenges associated with the management and continued persistence of Gunnison sage-grouse. The primary threat, however, is the permanent loss, and the associated fragmentation, of sagebrush (Gunnison Sage-grouse Rangewide Steering Committee 2005). These threats are amplified by land ownership patterns, especially where the risk of urban expansion and/or habitat conversion is high. Currently, the majority of the occupied habitat occurs on private land; therefore, the amount of conservation benefit provided by lands administered by the TRFO would be minimal for these subpopulations. In the Dove Creek area (41,284 acres), for example, private lands make up roughly 79% of the proposed occupied critical habitat, while BLM lands account for approximately 21%. The amount of TRFO-administered lands is even smaller for the Miramonte subpopulation, which covers approximately 6,782 acres of proposed occupied critical habitat (where BLM lands make up approximately 41% of the proposed occupied critical habitat). In the Dry Creek area proposed occupied critical habitat is approximately 61,823 acres; however, most (approximately 57%) of the occupied habitat occurs on BLM lands; therefore, the TRFO may have more of a management influence on the Dry Creek subpopulation. There is at least one known lek on BLM lands in the Dry Creek Basin. It is possible that leks in the basin exist that have not been identified. Lek sites do occur on adjacent private and state lands, and the habitats on BLM lands are important in providing nesting and brood-rearing habitat in conjunction with those lek sites.

In 2005, the Gunnison Sage-grouse Rangewide Conservation Plan (Gunnison Sage-grouse Rangewide Steering Committee 2005) was completed in order to supplement information in the local conservation plans and provide a range-wide perspective regarding the conservation of Gunnison sage-grouse. Conservation efforts for the Gunnison sage-grouse within the planning area would continue through the opportunities identified in these plans and through local partnerships, as opportunities arise.

North American Wolverine

On February 4, 2013, the USFWS published a proposed rule to list the distinct population segment (DPS) of the North American wolverine occurring in the 48 contiguous United States as a threatened species under the ESA (USFWS 2013b). The proposed rule did not propose any critical habitat for the species. The primary reason for the proposed listing was threats to habitat from global climate change. There are numerous historical records of wolverines from the Colorado Rocky Mountains.

However, the species is believed to have been extirpated from the southern Rocky Mountains including Colorado, New Mexico, and Wyoming by the early 1900s. In May 2009 a radio-collared male wolverine was tracked from the Yellowstone ecosystem south into north-central Colorado, becoming the first confirmed wolverine occurrences in Colorado since 1919 (Inman et al. 2009).

Climate change has been projected to have the potential to reduce suitable wolverine habitat by 31% in the contiguous United States by the year 2045, and by 63% by 2099 (USFWS 2013b). Deep snow that persists into the month of May is essential for wolverine reproduction. Reproduction is the life-history parameter likely to be most sensitive to climate changes, but year-round wolverine habitat, not just denning habitat, is likely to be reduced due to the effects of climate change. Human activities, including dispersed recreation activities, infrastructure, and the presence of transportation corridors, occur in occupied wolverine habitat. The alpine and subalpine habitats preferred by wolverine, however, typically receive less human use than lower-elevation habitats. Land management activities such as timber harvest, prescribed fire, and silviculture can modify wolverine habitat, but this wide-ranging generalist species does not appear to be greatly affected by changes in vegetation. For these reasons, the USFWS (2013b) determined that “human activities and developments do not pose a current threat to wolverines in the contiguous United States” and forest management activities “would not significantly affect the conservation of the DPS.”

The SJNF and TRFO are thought to provide a large amount of apparently suitable wolverine habitat, mostly in alpine and subalpine areas. Although the San Juan Mountains are at the southernmost extent of the known historic wolverine range (Aubry et al. 2007; USFWS 2013b), the large area within the San Juan Mountains that is at relatively high elevation appears to provide an abundance of alpine habitats with late season snowfields that are central to wolverine ecology.

<u>Wildlife Issues Related to Threatened and Endangered Species</u>

Many of the issues with past management practices remain issues for future management, and some new challenges have developed for future management practices. Management activities such as timber harvest and livestock grazing may not differ measurably from those conducted under the current LRMP. Other activities such as mineral development and recreation are likely to increase under the new LRMP, thereby presenting additional challenges to species conservation practices for the next 15 to 20 years.

Maintain or Improve Landscape Connectivity for Canada Lynx: A wildlife management challenge for threatened and endangered species is to maintain or improve wildlife movement corridors, particularly landscape connectivity for Canada lynx and other large carnivores and maintaining movement opportunities across state and federal highways (see the wildlife travel corridors discussion presented above). Roads constitute one of the greatest potential impacts to landscape connectivity and maintenance of biodiversity. For example, roads can result in direct mortality and habitat loss, provide barriers to dispersal, alter behavior and habitat use, increase parasitism and predation, and present habitat modifications (including increased edge habitat and exotic species introductions) (McGarigal et al. 2001; Trombulak and Frissell 2000;). All of these effects have been observed, to varying degrees, on the SJNF and TRFO over the past 15 to 20 years. There is potential for these effects to continue or increase during the next 15 to 20 years. In most cases, highways and primary use roads amplify these impacts due to the high amount and characteristics of traffic. The design of movement corridors or landscape linkages is accepted as a primary means of maintaining connectivity (Noss and Harris 1989; Rosenberg et al. 1997).

As discussed previously, the primary ecological rationale for movement corridors in wildlife conservation is to increase population persistence by allowing the continued exchange of individuals

among a previously connected population (Rosenberg et al. 1997). This is important for certain species, and needs vary from species to species. For example, large forest carnivores such as Canada lynx generally have large territories. Lynx utilize areas of connected habitat within their home range and for dispersal across large landscape areas (Ruediger et al. 2000). Busy highways can form obstacles to wildlife movement with results that may vary from high vehicle collision mortalities to totally impeding seasonal movements. Several lynx mortalities have been documented on federal highways that cross the SJNF and TRFO. Due to the naturally fragmented nature of the southern Rocky Mountain landscapes (Preston and Kingery 1998), there are inherently important natural topographic and vegetation features that link disconnected patches of primary habitat and promote movement and habitat connectivity (Ruediger et al. 2000). Ridgelines, drainages, and saddles are examples of these features.

The reintroduction of the Canada lynx to the southern Rockies in 1999 facilitated the need to identify where these inherent movement corridors are crossed by high-impact features, such as highways, so that dispersal and interchange among individuals could occur. A total of six landscape linkages have been identified on the SJNF and TRFO (Inter-Agency Southern Rockies Lynx Project Decision Screens [USFS 2010a]), of which five are on NFS lands and one is on BLM-administered lands.

In response to the ongoing management challenge and management opportunity of providing for landscape connectivity on the SJNF and TRFO for the purpose of maintaining population persistence of wide-ranging species such as Canada lynx, a variety of standards and guidelines were developed to maintain or improve habitat conditions and movement opportunities within important wildlife travel corridors. These standards and guidelines are expected to maintain or improve movement of animals between seasonal ranges and across large interconnected landscapes. This should maintain or improve connectivity of wildlife populations across large interconnected landscapes such as the San Juan Mountains. These standards and guidelines are in addition to all goals, objectives, standards, and guidelines contained in the Southern Rockies Lynx Amendment Record of Decision (USFS and Colorado Department of Natural Resources 2008) and Implementation Guide (USFS and USFWS 2009). The SRLA (USFS 2008b) is completely incorporated into the LRMP direction and would be applied to all land management decisions affecting NFS lands within the planning area. The SRLA was a USFS decision that does not apply to BLM lands within the planning area. BLM decisions are not obligated to consider the management direction contained in the SRLA. Management of lynx habitat on BLM lands is guided by the LCAS (Ruediger et al. 2000). The LCAS provides direction to identify and map linkage areas, and to manage habitats within identified linkage areas to promote and maintain habitat connectivity and animal movement.

Maintain or Improve Sage-grouse Habitat Capability: Sagebrush shrublands on the SJNF and TRFO have been altered through historic grazing and rangeland management practices. Long periods of intensive livestock grazing, changes in the type of livestock, periods of extended drought, and invasion of non-native plants have reduced the species diversity and abundance of native grasses and forbs in the sagebrush understory. The impacts of past management activities and poor habitat conditions of sagebrush shrublands, as well as conversion of sagebrush shrublands on intermixed private lands, have led to declines in sage-dependent species. In response to continued range-wide population declines, Gunnison sage-grouse was recently proposed for listing as endangered under the ESA (USFWS 2013c). Designation of critical habitat was also proposed (USFWS 2013d), including some portions of the planning area.

A variety of standards and guidelines were developed to maintain or improve habitat conditions in sagebrush shrublands, especially in Gunnison sage-grouse habitat areas. Management direction is intended to maintain and improve ecological function of sagebrush shrublands, and maintain and

improve habitat effectiveness in sage-grouse key habitat areas (nesting habitats, lekking areas, brood-rearing and wintering habitats). Due to low population numbers and the species' demonstrated sensitivity to human disturbance during some times of the year, management direction is also designed to reduce human disturbance in key sage-grouse habitats and at times of the year when birds are most sensitive to disturbance.

Bureau of Land Management and U.S. Forest Service Sensitive Terrestrial Wildlife Species

BLM and USFS sensitive terrestrial wildlife species are species that are in need of conservation attention to reduce downward trends on agency lands or throughout portions or all of their ranges. Sensitive species are those for which some management actions and direction are necessary in order to prevent listing of these species under the ESA. Management direction is also necessary so that land management activities do not contribute to a loss of species viability. Of the species listed below (Table 3.3.3), two species are candidates for federal listing and one species has been petitioned for federal listing. Each agency applies specific conservation criteria for evaluation in determining which species warrant sensitive species classification for the state or region on agency lands. The BLM and USFS sensitive terrestrial wildlife species under consideration in this LRMP/FEIS are listed in Table 3.3.3. The species shown in Table 3.3.3 include 12 mammals, 20 birds, three amphibians, two reptiles, and one insect species from the BLM Colorado and USFS Region 2 sensitive species lists.

Table 3.3.3: TRFO and SJNF Sensitive Wildlife Species and Habitat Association

Species	Agency Designated	Habitat Association
Birds		
American bittern Botaurus lentiginosus	USFS	Marsh, swamp, or bog with cattails, rushes, grasses, and sedges
Bald eagle Haliaeetus leucocephalus	BLM and USFS	Lakes, reservoirs, rivers, and adjacent conifer and cottonwood riparian forest; primarily a winter visitor but also reproduces on the SJNF
Black swift Cypseloides niger	BLM and USFS	Vertical rock faces near waterfalls or in dripping caves
Boreal owl Aegolius funereus	USFS	Mature spruce-fir forests with high canopy closure
Brewer’s sparrow Spizella breweri	BLM and USFS	Primarily sagebrush but also in mixed shrublands (rabbitbrush and greasewood)
Columbian sharp-tailed grouse Pediocetes phasianellus columbianus	BLM	Oak/serviceberry shrublands, often interspersed with sagebrush; aspen forests; irrigated pasture; recently reintroduced near Dolores, not expected for other units
Ferruginous hawk Buteo regalis	BLM and USFS	Grasslands and semi-desert shrub; not known to breed but a regular winter resident on the SJNF
Flammulated owl Otus flammeolus	USFS	Open ponderosa pine forests and dry montane conifer or aspen forests, often with dense saplings
Lewis’ woodpecker Melanerpes lewis	USFS	Open ponderosa pine forest, riparian, and pinyon-juniper woodlands
Loggerhead shrike Lanius ludovicianus	USFS	Lowland riparian, pinyon-juniper woodlands, and semi-desert shrublands
Northern goshawk Accipiter gentilis	BLM and USFS	Ponderosa pine, aspen, mixed conifer, and spruce-fir forests

Species	Agency Designated	Habitat Association
Northern harrier Circus cyaneus	USFS	Grasslands, agricultural lands, mountain sagebrush, and marshes; requires abundant cover (same as for short-eared owl)
Olive-sided flycatcher Contopus cooperi	USFS	Snags and conifers, often on steep slopes, open stands, and natural openings
Peregrine falcon Falco peregrinus anatum	BLM and USFS	Breeds on cliffs, often in association with riparian areas; regular breeder on the SJNF
Purple martin Progne subis	USFS	Mature aspen stands near streams, springs, or ponds
Short-eared owl Asio flammeus	USFS	Open habitats, including grasslands, marsh edges, shrub-steppe, and agricultural lands; requires taller grass cover than northern harrier
Western burrowing owl Athene cunicularia	BLM and USFS	Prairie dog colonies with vacant burrows; grasslands, shrublands, and deserts
Western yellow-billed cuckoo Coccyzus americanus	BLM and USFS, Also ESA Candidate	Riparian; gallery cottonwoods with dense understory
White-faced Ibis Plegadis chihi	BLM	Spring/fall migrant only; wet meadows, marsh edges, and reservoir shorelines
White-tailed ptarmigan Lagopus leucurus	USFS	Alpine tundra, especially with rock fields and willow carrs
Insects		
Great Basin silverspot butterfly (Nokomis fritillary butterfly) Speyeria nokomis nokomis	BLM and USFS	Riparian; mostly tied to springs
Mammals		
Allen's big-eared bat Idionycteris phyllotis	BLM	Woodlands, mines, and caves
American marten Martes americana	USFS	Subalpine spruce-fir forests, alpine tundra, and montane forests
Big free-tailed bat Nyctinomops macrotis	BLM	Rocky and canyon country
Desert bighorn sheep Ovis canadensis nelsoni or mexicana	BLM	Dolores River canyons, grass and low shrub open habitat types with adjacent steep and rocky areas for escape cover and safety
Fringed myotis Myotis thysanodes pahasapensis	BLM and USFS	Pinyon-juniper and other coniferous woodlands
Gunnison's prairie dog Cynomys gunnisoni	BLM and USFS	Grasslands and semi-desert and montane shrublands
Hoary bat Lasiurus cinereus	USFS	Associated with foliage in trees, mainly ponderosa pine, piñon/juniper and riparian forest
New Mexico meadow jumping mouse Zapus hudsonius luteus	BLM and USFS, Also ESA Candidate	Mesic grass/forb/sedge riparian habitat
North American river otter Lontra canadensis	USFS	Stream and river riparian
Rocky Mountain bighorn sheep Ovis canadensis canadensis	USFS	Steep terrain dominated by grass, low shrubs, and rock areas
Spotted bat Euderma maculatum	BLM and USFS	Pinyon-juniper, shrub desert, and possibly riparian
Townsend's big-eared bat Corynorhinus townsendii	BLM and USFS	Abandoned mines and caves

Species	Agency Designated	Habitat Association
Reptiles		
Desert spiny lizard Sceloporus magister	BLM	Shrub-covered dirt banks and sparsely vegetated rocky areas near flowing streams
Longnose leopard lizard Gambelia wislizenii	BLM	Intermittent streams and pools in deep rocky canyons
Amphibians		
Boreal toad Bufo boreas	BLM and USFS	Damp conditions; marshes, wet meadows, streams, ponds, and lakes
Canyon tree frog Hyla arenicolor	BLM	Intermittent streams and pools in deep rocky canyons
Northern leopard frog Rana pipiens	BLM and USFS	Water's edge; wet meadows, banks of marshes, and ponds

Wildlife Issues Related to BLM and USFS Sensitive Species

Bighorn/Domestic Sheep Contact: Bighorn sheep are classified as big game in Colorado and are highly valued by big game hunters and the public for wildlife watching opportunities. Bighorn sheep are designated as Colorado's official state animal and are the symbol for the state's wildlife management agency, CPW. Management of big game animals in Colorado is based on Game Management Units (GMUs), which are grouped into Data Analysis Units (DAUs). Colorado uses DAUs as the basis for managing big game populations (George et al. 2009). GMUs represent relatively discrete herds, whereas DAUs represent population complexes formed by adjacent GMU herds that are thought to interact as a complex of connected subpopulations (Peck 1998).

There are four Rocky Mountain bighorn sheep DAU population complexes in the planning area. The Weminuche DAU population complex is composed of three discrete herds (GMUs), Sheep Mountain S-15, Cimarrona Peak S-16, and Vallecito Creek S-28, which are thought to interact as connected subpopulations. A DAU plan was completed in 2012 for the Weminuche population complex (CPW 2012a). This population occurs on the SJNF portion of the planning area. The San Juans West DAU population complex is composed of two discrete herds (GMUs), Upper Lake Fork/Pole Creek Mountain S-33 and Cow Creek S-21. These two herds are thought to interact as connected subpopulations, forming a population complex. A DAU plan was completed in 2012 for the San Juans West population complex (CPW 2012b). This population occurs on the TRFO portion of the planning area. The South San Juans DAU population complex is composed of three discrete herds (GMUs), Sheep Mountain S-31, Alamosa Canyon S-29, and Conejos River S-30. These herds are thought to interact as connected subpopulations, forming a population complex. A DAU plan has not been developed for this population complex. This population occurs on the SJNF portion of the planning area. The Animas River population is composed of a single bighorn herd (GMU), West Needles S-71, which occurs on the SJNF portion of the planning area. A DAU plan has not been developed for this population. The Weminuche and South San Juans population complexes also occupy portions of the Rio Grande National Forest, while the Animas River population is located entirely within the SJNF planning area. The San Juans West population complex is located partially on TRFO lands, but is located mostly on BLM lands managed by the Gunnison Field Office and NFS lands managed by the Gunnison National Forest.

There is also one desert bighorn sheep herd complex in the planning area. The Dolores River population complex is composed of two discrete herds (GMUs), Upper Dolores River S-64 and Middle Dolores River S-63. These herds are thought to interact as connected subpopulations, forming a population complex. The Dolores River desert bighorn sheep population complex is located on

portions of the TRFO but also occupies portions of the BLM Uncompahgre Field Office. A DAU plan has not been completed for this population complex.

Rocky Mountain and desert bighorn sheep are classified as USFS and BLM sensitive species. Desert bighorn sheep only occur on the TRFO portion of the planning area. Both subspecies are classified as big game species in Colorado. The CPW sets and monitors harvest levels to manage for healthy populations. Inventory and monitoring of both species is conducted by CPW in cooperation with the land management agencies.

All bighorn herds on the SJNF and TRFO have increased over the past 20 years. The 2011 post-hunt population estimate for the Weminuche DAU was 460 bighorns, and the current population objective is to allow the population to expand to a maximum of 4.4 bighorn/square kilometer. The 2011 post-hunt population estimate for San Juans West DAU was 450 bighorns, and the current population objective is to maintain current population density at about 2.0 bighorn/square kilometer. The 2011 post-hunt population estimate for the South San Juans DAU was 210 bighorns, and 60 bighorns for the Animas River DAU. The post-hunt population estimate for Dolores River DAU was 100 bighorns.

A primary issue associated with management of bighorn sheep involves their high susceptibility to a variety of diseases and parasites, many of which can be contracted from physical contact with domestic sheep or goats (Geist 1971). For example, no studies report any bighorn sheep herds, fenced or free ranging, that have come in contact with domestic sheep and remained healthy (Martin et al. 1996). Bacteria, primarily the genus *Pasteurella*, have been documented to cause the primary diseases that can lead to bighorn sheep mortality events across all age groups. Physical contacts between bighorns and domestic sheep are presumed to have resulted in large-scale rapid die-off events of bighorn sheep, which can represent large losses of many years and costly efforts to restore the species to its former range. The loss of genetic diversity and herd memory of historical migration routes and wintering and lambing areas may also be irreplaceable when attempting to restore bighorns after a die-off event.

There have been no confirmed bighorn die-off events on the SJNF or TRFO. There is, however, strong circumstantial evidence a mortality event occurred in 1988 after observed close proximity and presumed physical contact between domestic sheep and a small number of transplanted bighorn sheep on NFS lands in the Vallecito Creek S-28 herd, which is a subpopulation of the Weminuche DAU. None of the transplanted bighorn sheep were known to have survived their first winter season, and a complete mortality event of the transplanted animals is assumed to have occurred.

There is a very small amount of overlap between occupied bighorn range and stocked domestic sheep allotments on the SJNF and TRFO. Many of the historic domestic sheep allotments that overlap occupied and historic bighorn herd ranges on the SJNF have remained vacant for one or more decades, thereby reducing the potential for disease transmittal between domestic and bighorn sheep. Currently, there are 28 domestic sheep and goat allotments on NFS lands in the planning area. Of these 28 allotments, 12 are active and currently stocked on an annual basis, 11 are vacant but available for stocking, and five are designated as forage reserves, only available for occasional stocking in response to unusual environmental or permittee circumstances. All active domestic sheep allotments that are stocked in the planning area have been stocked annually since the 1980s.

In response to the potential for impacts to existing healthy bighorn sheep herds, and in response to desire for the USFS and BLM to continue providing domestic sheep and goat grazing opportunities within the planning area, standards and guidelines were developed to prevent or otherwise mitigate the potential for physical contact between bighorn and domestic sheep, thereby likely reducing the potential of a bighorn sheep mortality event. Continuing to provide the livestock grazing opportunities

that have played an important role in local history and the area's agricultural economy, while also providing for healthy and self-sustaining populations of bighorn sheep within native ranges is a management challenge that would continue into the foreseeable future.

White-tailed Ptarmigan Population Persistence: White-tailed ptarmigan is endemic to alpine habitats of western North America, primarily at or above the treeline, and is found across alpine portions of the SJNF and TRFO (Hoffman 2006). They also use riparian zones, meadows, and willow carrs near the treeline in the subalpine zone (Braun and Rogers 1971; Braun et al. 1976; Gellhorn 2007). Ptarmigan is one of only five bird species whose primary breeding habitat is the alpine zone above the treeline. Ptarmigan have a highly disjunct range and do not occur in Idaho, Oregon, California, or Utah, and may be extirpated from Wyoming (Gellhorn 2007; Hoffman 2006; USFWS 2012b). Ptarmigan are legally hunted in Colorado, and some easily accessible ptarmigan populations may be vulnerable to over-harvest due to their unwary behavior and their habit of concentrating in large flocks in traditional use areas (Braun and Rogers 1971; Braun et al. 1976; Hoffman 2006).

The southern subspecies of white-tailed ptarmigan, including all the species' range in Colorado, was petitioned for listing as threatened under the ESA in 2010 (Center for Biological Diversity 2010). The petition suggested that global climate change could reduce ptarmigan habitat substantially in northern portions of the species' range and predicted the species could be eliminated from the contiguous United States by the year 2061 (USFWS 2012b). In response to this petition, the USFWS published a 90-day finding that determined substantial information had been presented in the petition sufficient to warrant conducting a status review of the species and determine if listing is warranted (USFWS 2012b). The 12-month finding from this status review has not been published.

The single most important habitat feature used by ptarmigan in Colorado is willow, which is their primary food source from late fall through spring (Braun et al. 1976; Braun et al. 1991). Any activity that reduces the distribution and abundance of willow would likely have negative consequences to ptarmigan (Braun et al. 1976; Braun et al. 1991; Hoffman 2006). Snow characteristics are also believed to be important to winter survival of the species because ptarmigan roost at night in burrows beneath the snow surface to escape the coldest temperatures (Braun and Rogers 1971; Gellhorn 2007; Hoffman 2006). Snow conditions that prevent burrowing (crusts and compacted snow) could reduce survival (Braun and Rogers 1971). Because ptarmigan become concentrated in winter on relatively few traditional use areas, it is evident that these winter use areas are limited and that they support a major portion of the local breeding population from surrounding areas (Braun et al. 1976). Because of this concentration effect, it is very important to maintain habitat capability within known winter use areas, and declines in habitat capability within these small traditional winter use areas are likely to affect breeding populations across a much larger portion of surrounding alpine areas (Braun et al. 1976).

Ptarmigan populations in the southwest Colorado ore belt, roughly between Telluride, Silverton, and Lake City, including USFS and BLM lands on the SJNF and TRFO, are thought to not be self-sustaining. Research by Larison et al. (2000), conducted in part on the SJNF and TRFO, demonstrates that reduced over-winter survivorship of adult female ptarmigan caused by cadmium-induced renal failure and brittle bones limits ptarmigan breeding densities and productivity in this area. Cadmium naturally occurs in high concentrations in the Colorado ore belt and is readily mobilized by mining. Cadmium is taken up by willows and biomagnified in the buds, which are the primary winter food source for ptarmigan (Hoffman 2006). Given the documented physiological impacts of cadmium-induced renal failure in ptarmigan, there are questions about the potential for similar effects to other wildlife species that feed primarily on willow buds in these same areas in winter, such as snowshoe hare and moose. Because cadmium toxicity has reduced survivorship of

adult female ptarmigan, ptarmigan population persistence in the SJNF and TRFO portions of the Colorado ore belt may depend on maintaining and improving habitat capability and effectiveness within traditional ptarmigan winter use areas, at least until such time that cadmium bioaccumulation effects in willows can be reduced through reduced mine drainage and improved water quality. Ptarmigan populations in the Silverton area may be especially vulnerable to degraded habitat capability of traditional winter use areas because population densities in this area are much lower than other areas and are likely not self-sustaining (Larison et al. 2000).

Declines in habitat capability and effectiveness within ptarmigan traditional winter use areas have occurred over the life of the current LRMP due to substantially increased amounts and extents of winter recreation, motorized and non-motorized, within and around some ptarmigan traditional winter use areas. Increases in motorized recreation have resulted from substantially improved snowmobile technology and increased numbers of oversnow motorized users. Motorized recreation impacts to ptarmigan habitat occur in two primary ways: disturbance from machines and associated human activities and compaction of unconsolidated snow used by ptarmigan for overnight burrows (Braun et al. 1976; Hoffman 2006). Advancements in snowmobile technologies and capabilities have expanded motorized access and impacts into previously inaccessible areas and expanded motorized impacts into formerly undisturbed and untracked backcountry areas. The total number of motorized users has also increased, especially in more readily accessible recreation areas, some of which are also traditional ptarmigan winter use areas (Braun et al. 1976; Giesen and Braun 1992). Non-motorized winter recreation has also increased over the life of the current LRMP, especially in areas that are close to high mountain passes, some of which are also traditional ptarmigan winter use areas (Braun et al. 1976). Overall, general human presence and activities have increased in some formerly less disturbed ptarmigan traditional winter use areas. Recent reductions in ptarmigan presence have been observed in some ptarmigan traditional winter use areas on the SJNF and TRFO (Braun et al. 1976). Flushing and displacement of birds from preferred habitats may increase their vulnerability to predation, force them to expend energy, or temporary displace them from optimal feeding, roosting, and/or loafing sites (Gellhorn 2007; Hoffman 2006;). Compaction of snow and physical damage to tops of willows are some negative impacts by snowmobiles and snowshoe and skier traffic that have been observed in ptarmigan traditional winter use areas on the SJNF and TRFO. These observed winter recreation impacts have possible direct consequences to ptarmigan habitat capability (Braun et al. 1976; Braun et al. 1991; Hoffman 2006).

A management challenge is to maintain or improve the amount and effectiveness of ptarmigan traditional winter use areas, especially those used by female ptarmigan, in the SJNF and TRFO portions of the Colorado ore belt. Maintaining and improving habitat effectiveness of ptarmigan traditional winter use areas for female ptarmigan is necessary to offset the toxic effects of cadmium-induced renal failure causing reduced female survivorship resulting in ptarmigan densities much lower in this area than other areas and causing populations in this area to not be self-sustaining. In response to this management challenge and wildlife habitat improvement opportunity, standards and guidelines were developed in the wildlife section and abandoned mines and hazardous materials section of Volume II, LRMP, to maintain and improve water quality, reduce the potential for heavy metal bioaccumulation in willows, and maintain habitat capability in ptarmigan traditional winter use areas.

U.S. Forest Service Management Indicator Species

Species are generally selected as MIS because their population changes are believed to indicate the impacts of management activities. MIS are not a planning tool utilized by the BLM and there are no BLM requirements to designate or analyze MIS. For this reason, the following MIS discussion applies

only to the SJNF planning process and where the selected species occur on SJNF lands. MIS can be chosen from five categories of species listed below:

- endangered and threatened plant and animal species identified on state and federal lists;
- species commonly hunted, fished, or trapped;
- non-game species of special interest;
- species with special habitat needs that may be influenced significantly by planned management programs; and
- additional plant or animal species selected because their population changes are believed to indicate the impacts of management activities on water quality.

Within the context of this planning process and for analysis within this FEIS, MIS are used for the purpose of assessing the impacts of the LRMP alternatives on wildlife populations where they occur on SJNF lands. MIS are species monitored to assess the effects of management activities, related to specific management issues, on their populations and on the habitats with which they are associated. Changes in MIS populations could indicate that current management is affecting the composition, structure or function of associated habitats, or the management issue for which they were selected. This could result in indications that LRMP direction and desired conditions need to be revised or indicate the need for adjusting management actions under an adaptive management framework. Table 3.3.4 shows terrestrial wildlife MIS selected from the represented categories, habitat of concern, and management issues addressed for the SJNF. A total of four species were selected as MIS on the SJNF: Abert's squirrel, American marten, elk, and hairy woodpecker. Due to their widespread distribution across the SJNF and the relative abundance of these four species, their viability across the SJNF is not of concern.

The concept of MIS does not apply beyond NFS lands. The regulatory requirement to designate MIS or conduct assessments of effects to MIS does not apply to actions occurring on BLM lands. It should be recognized that the species selected as MIS on the SJNF also occur on adjacent BLM lands and that management actions on these BLM lands contribute to maintaining healthy habitats and populations widely distributed across the region, as well as on the SJNF planning area. Because the MIS concept and requirement does not apply to BLM lands or management actions, the following MIS discussions apply only to lands and actions carried out by the SJNF.

Table 3.3.4: U.S. Forest Service Terrestrial Wildlife Management Indicator Species

Management Indicator Species	LRMP Issues For Selection
Abert's squirrel (Sciurus aberti)	Impacts to native species and their habitat associated with changing the structure and function of ponderosa pine forests due to timber harvesting activities and fuels treatments that remove ponderosa pine trees and Gambel oak.
American marten (Martes americana)	Impacts to native species and their habitat in spruce-fir, cool-moist mixed conifer, and aspen forests due to recreation and timber harvest activities.
Hairy woodpecker (Picoides villosus)	Impacts to native species and their habitat associated with changing the composition, structure, and function of aspen, ponderosa pine, and mixed conifer forests due to timber harvest and fuels treatment activities.
Elk (Cervus canadensis)	Impacts to native species and wildlife winter range (pinyon-juniper woodlands, sagebrush shrublands, mountain shrublands, and ponderosa pine forests) due to recreation activities, fuels

Management Indicator Species	LRMP Issues For Selection
	treatments, oil and gas development, and timber harvesting activities.

Abert's Squirrel

Abert's squirrel is unique in that its life necessities are almost entirely provided by a single plant species: ponderosa pine. Preferred habitats are stands of all-aged ponderosa pine (with even-aged groups within the stands), open understories, and high canopy base levels (Patton 1975). These squirrels may also be found in Gambel oak and pinyon-juniper forest types (frequenting such types only when they are associated with ponderosa pine). Depending on the season, primary food sources are seeds, inner bark, terminal buds, and staminate flowers of ponderosa pine; fleshy fungi; and acorns from Gambel oak. Only foods from ponderosa pine and fleshy fungi are consumed in amounts important, from a quantitative point of view (Keith 1965). Nest trees are typically in a group of trees with interlocking crowns. Tree dominance strongly influences a squirrel's choice within a group. A nest tree located in a group of trees, with crowns interlocking or only a few feet apart, offers protection and alternate escape routes from predators.

Population limiting and controlling factors include insect and disease infestations, timber harvest, fire prevention and prescribed burns, oil and gas development, and livestock grazing that impact ponderosa pine habitat. All of these factors have the potential to influence food sources and nesting availability. Other population-influencing factors include hunting and vehicle collision.

Abert's squirrel is considered well-distributed throughout the planning area within suitable ponderosa pine habitat. The species was selected as an MIS to address the planning issue of impacts to native species associated with mature and late-seral ponderosa pine forests. Historically, changes have occurred in ponderosa pine forest conditions due to timber harvesting activities, fire prevention, livestock grazing practices, and more recent fuels treatment projects. Today, ponderosa pine forests have substantially fewer acres in late-successional stages than would be expected under HRV resulting in reduced habitat availability for species associated with those conditions, including Abert's squirrel. Suitable Abert's squirrel habitat is limited to mid- and late-successional ponderosa pine forests (wildlife habitat structural stages 4A, 4B, 4C, and 5 of the ponderosa pine type). Currently, there are an estimated 230,878 acres of suitable, and 121,717 acres of optimal, Abert's squirrel habitat on NFS lands within the planning area.

Habitat analysis shows the 20-year trend for suitable Abert's squirrel habitat is stable, with a slightly downward trend in optimal habitat. Population trends for the planning area are not thought to differ from the habitat trends (which are generally stable with a possible slight downward trend).

American Marten

The American marten is considered well-distributed throughout the planning area within suitable habitat. The species was selected as an MIS in order to address the planning issue of impacts to native species and their habitats in spruce-fir, cool-moist mixed conifer, and aspen forests. Changes in mid- and late-successional habitat conditions in these forest types have occurred due to historic timber harvesting activities, mining activities, and recreation activities. Suitable habitat is considered mid- and late-successional spruce-fir and cool-moist mixed conifer habitats (habitat structural stages 4A, 4B, 4C, and 5). Spruce-fir forest types would be considered primary habitat for this species.

Currently there are an estimated 604,228 acres of suitable habitat for American marten on NFS lands within the planning area. Habitat analysis shows the 20-year trend for suitable American marten habitat is stable across the planning area. Marten population trends for the planning area are not thought to differ from the habitat trends, but winter marten track monitoring for the past 8 years has shown a possible slight downward trend.

American marten prefer mesic (a habitat with moderate or well-balanced supply of moisture) forest conditions and forest stands with xeric (drier) conditions with structure near the ground (Buskirk and Ruggiero 1994). Marten appear to prefer overhead cover, and they usually avoid extensive use of open areas, particularly in winter. Within the planning area, habitat for the marten occurs at the mid- to upper-elevation zones. Complex physical structure, especially near the ground, appears to be an important component of marten habitat. These structures offer protection from predation, thermal microenvironments, and subnivean (under the snow layer) prey habitat during winter (Buskirk and Ruggiero 1994). On the SJNF, these features are most commonly found in mid- and late-successional forest stands.

The most important prey species for the marten in the southern portion of its range is the western subspecies of the southern red-backed vole (Buskirk and Ruggiero 1994). Therefore, habitat components that favor the southern red-backed vole would also be considered important attributes of marten habitat. In the western mountains the southern red-backed vole is considered to be most abundant in mesic, late-successional, coniferous forests (Hayward 1994; Hayward et al. 1993; Knight 1994). Another potentially important component of marten habitat is the squirrel "midden," and area on the forest floor where squirrels store their food (Buskirk and Ruggiero 1994). These structures provide natal and maternal dens and also serve as access to the subnivean space during winter. Red squirrels (*Sciurus vulgaris*) and snowshoe hare are also prey species of the marten. Other prey includes insects, birds, bird eggs, and fish. Marten will also take carrion when available, especially during the winter. "Soft mast" is consumed during the late summer and fall. "Soft mast" is seeds that are covered with fleshy fruit, such as apples and berries.

Changes in small-mammal prey can influence the carrying capacity of marten habitat (Buskirk and Ruggiero 1994). Food shortages have the greatest impact on female and juvenile martens due to their high energy requirements. Other population influences include geographic isolation, low population densities, low reproductive potential, predation, competing predators, parasites and disease, weather, and trapping. Influential management activities include timber management, recreation, livestock grazing, and fire management.

Elk

The elk is considered well-distributed throughout the planning area within suitable habitats. The species was selected as an MIS to address the planning issue of impacts to native species and wildlife winter range (pinyon-juniper woodlands, sagebrush shrublands, mountain shrublands, and ponderosa pine forests) due to recreation and travel management activities, fuels treatments, fire management, oil and gas development, livestock grazing, and timber harvesting. Elk are considered habitat generalists. They utilize a variety of vegetation types including aspen, cool-moist and warm-dry mixed conifer, mountain grassland, mountain shrubland, sagebrush, pinyon-juniper, ponderosa pine, and spruce-fir. Cover-to-forage percentage ratios are used in determining suitability of habitat, with the optimum ratio being 60:40 cover-to-forage. Currently, there are an estimated 539,957 acres of suitable winter habitats and an estimated 1,741,691 acres of suitable summer habitats distributed across SJNF lands within the planning area. Summer habitat trends are currently considered stable, and winter habitats are in an upward trend. Elk population trends increased from 1982 to the mid-1990s, where they peaked. Numbers are down from the mid-1990s, but the trend is considered

stable. No correlation is noted between habitat trends and population trends over time. At this time, it is believed that elk populations are primarily influenced by hunter harvest, with harvest levels set annually by CPW.

As generalist feeders, elk are both grazers and browsers. In the northern and central Rocky Mountains, grasses and shrubs compose most of the winter diet for elk, with grasses becoming of primary importance in the spring months. Forbs become increasingly important in late spring and summer, and grasses are again dominant in the fall. Forbs tend to be favored on drier sites, but browse is preferred in most mesic areas including aspen stands, willow communities, and moist meadows.

Elk tend to inhabit higher elevations during spring and summer, and then move to lower elevations for winter range. However, some elk herds are relatively sedentary. Migrating elk typically follow the melting snowpack upslope in spring; fall migrations are tied to weather and forage availability. Snow depth of about 16 inches triggers elk movement to winter ranges. Although elk can move through snow over 3 feet deep, this condition forces the animals to plow through snow in single file and change leaders as they tire. During winter, elk form large mixed herds on favored winter range. Impacts to adjacent private agricultural grounds within winter range have resulted in damage to crops and fences in local areas where public land winter range is not sufficient.

Calving grounds are carefully selected by cows, and are generally in locations where dense cover, forage, and surface water are in close juxtaposition. In western Colorado, most females calve within approximately 650 feet of water. Females with calves isolate themselves from the herd for the first 2 to 3 weeks. Once the calves are large enough, females with young rejoin the herd (Fitzgerald et al. 1994).

Population controlling and limiting factors include predation, hunting, parasites and disease, foraging competition, availability of winter habitat, and disturbance during critical life functions such as on winter range and calving areas. Influential management activities may include timber harvesting, fire management, fuels management, oil and gas development, livestock grazing, and recreation and travel management.

Hairy Woodpecker

The hairy woodpecker is considered well distributed throughout the planning area within suitable habitat. The species was selected as an MIS in order to address the planning issue of impacts to native species and their habitat associated with changing the composition, structure, and function of aspen forests due to clear-cut timber harvesting activities. On the SJNF, the hairy woodpecker uses spruce-fir, mixed conifer, ponderosa pine, aspen, and pinyon-juniper forests. Habitat is found within structural stages 4A, 4B, 4C, and 5. Within the planning area, woodpecker habitat is essentially stable over the past 20-year period. Woodpecker population trends are also considered stable for NFS lands within the planning area (White et al. 2012). It is estimated that approximately 1,137,282 acres of suitable hairy woodpecker habitat currently occur across NFS lands within the planning area.

Hairy woodpeckers are primary cavity nesters, constructing their own cavities (Winternitz 1998). The primary diet consists of insects gleaned from tree trunks and primary branches. Snags are a crucial habitat component for hairy woodpeckers. They generally select large-diameter (more than 16 inches dbh) trees to excavate cavities (Schultz 2001). Within the planning area, hairy woodpecker nest cavities are found in pinyon-juniper, ponderosa pine, mixed conifer, spruce-fir, and aspen habitats (Winternitz 1998). Hairy woodpeckers are known to favor aspen or trees with decayed heartwood and excavate a new hole each year.

Species limiting and controlling factors include nest site availability (i.e. snag size and abundance), food availability, fire, and weather. Land management actions that could influence populations include timber harvesting, fire management, fuelwood cutting, and livestock grazing.

3.3.3 Environmental Consequences

Nearly all multiple-use activities conducted in the planning area under LRMP implementation and described in this analysis have some potential to impact terrestrial wildlife habitats, species, or individuals. Based on the habitat and species assessments described above, the greatest potential impacts from LRMP implementation activities to terrestrial wildlife species and habitats are from management activities that directly affect key habitat components associated with species abundance and/or distribution or occur within key wildlife use areas. Activities that have greater potential to affect wildlife habitat capability or species include travel management, oil and gas development, road construction and road management, livestock grazing, fire and fuels management, hard-rock mining, and timber management. Activities with lesser impacts include aquatic and riparian habitat improvement projects, watershed improvement projects, abandoned mines and hazardous materials projects, developed recreation facilities, prescribed burns, utility corridor ROWs, and ski area modifications and expansion.

The goal of all LRMP alternatives is to provide ecological conditions that support a diversity of native and desired non-native terrestrial wildlife species over the long term and that promote the recovery of federally listed species. See Volume II, LRMP, Section 2.1 for additional discussion about the Ecological Framework and the Conservation of Species on the SJNF and TRFO. The sustainable ecosystems strategy includes 1) protected area designation and preservation (a coarse-filter approach), 2) ecosystem management using sustainable ecosystem concepts, 3) the development and application of LRMP components (desired conditions, objectives, standards, and guidelines) that provide a framework for the management and preservation of ecosystems, and 4) monitoring of the effects of management activities on the TRFO and SJNF and the application of adaptive management principles. Ecological sustainability is intended to provide the ecological conditions that maintain or restore the diversity of native ecosystems and natural disturbance processes. This in turn would maintain suitable habitats for a wide range of plant and animal species and provide for the diversity and viability of plant and animal species, populations, and communities. When applied effectively, the sustainable ecosystems strategy would result in ecological conditions similar to those under which native species evolved. Because all LRMP alternatives are based on the sustainable ecosystem strategy and LRMP components apply to all LRMP alternatives, implementing any of the four alternatives would provide a range of habitat requirements sufficient to provide for the needs of species by managing for objectives that result in the desired conditions outlined in the LRMP.

The maintenance of biological diversity and population viability on public lands are addressed directly or inferred under a variety of laws, regulations, and policies (see LRMP Section 2.1.4). The sustainable ecosystems and species management strategies for the SJNF and TRFO combine to provide a foundation for addressing these legal, regulatory, and policy requirements. The underlying assumption is that implementing a management strategy that maintains sustainable ecosystems, along with a species strategy that addresses the specific needs of selected species, would provide for species diversity and long-term population viability, in as much as species diversity and population viability can be tied to the management of local federal lands. These two strategies are implemented through the LRMP components, which provide a framework for the management and protection of ecosystems, populations, and individual species occurring on the SJNF and TRFO. For each of the riparian area and wetland ecosystems, aquatic ecosystems, and terrestrial ecosystems, specific management direction has been developed that is intended to address the legal, regulatory, and

policy requirements for species diversity and population viability. The process applied was to identify a range of key ecosystem elements, determine the importance of those elements to maintaining species diversity and population viability (e.g., limiting factors), define desired future conditions and land management objectives for those elements, and ensure that appropriate management standards and guidelines are in place that address the ecological needs of species and populations (see Appendices M and Q).

The strategy of all alternatives, each of which addresses a different mix of multiple use opportunities and objectives, is to provide conditions (within the land's capability) that would support the full complement of native and desired non-native terrestrial wildlife species within the planning area. Guidance provided in the desired conditions, referenced direction, objectives, standards, and guidelines (components of the LRMP) would contribute toward recovery and delisting of federally listed and proposed species. This guidance would also contribute to preventing BLM and USFS designated sensitive species trending toward federal listing. Following publication of the Draft LRMP, new information concerning increased projections for fluid minerals development resulted in the preparation of a supplement to the draft. The relevant analysis prepared for the supplement is found in a fluid minerals section presented at the end of this Terrestrial Wildlife section.

Implementation of management actions conducted under the Preferred Alternative would move ecological conditions toward desired conditions in the planning area. Consistent monitoring of project implementation outcomes on species and habitat conditions would provide a feedback mechanism for evaluating the LRMP's ecological approach and help identify needs for possible LRMP amendments or other changes in management practices. Tracking changes in key areas, and for specific species of interest, would continue to be an important component in demonstrating accomplishment of objectives and achieving desired conditions for the wildlife program.

LRMP implementation is expected to involve continued close coordination with CPW and the USFWS. Close cooperation with CPW and the USFWS is critical for wildlife program implementation but partnerships with local, state, Native American tribal, and other federal agencies, as well as with interested non-governmental organizations and individuals is necessary to achieve optimal wildlife management outcomes on the SJNF and TRFO. Such partnerships also serve as important mechanisms to achieve desired conditions and accomplish multiple use objectives.

Environmental consequences related to multiple-use activities are generally expected to be proportional to the magnitude and extent of activities that occur in key wildlife habitat areas or the degree to which they affect key wildlife habitat components that are directly related to species distribution or abundance. Potential impacts would be minimized through the application of standards and guidelines, including management direction referenced in the LRMP that frame BMPs applied to USFS and BLM lands, and standards and guidelines described in the LRMP. With the application of LRMP standards and guidelines and applicable management direction contained in other referenced guidance, project design criteria are expected to be effective in reducing impacts. Monitoring the outcome of LRMP implementation activities is necessary to confirm effectiveness of LRMP standards and guidelines. With effective implementation of LRMP standards and guidelines and applicable management direction from other referenced guidance, adverse impacts to wildlife resources from LRMP implementation activities are expected to be generally minor and localized and are not expected to result in measureable changes to species abundance or distribution across the planning area. However, as the intensity or extent of LRMP implementation activities increases, e.g., under Alternative D compared to other alternatives, conservation practices may be less effective at preventing cumulative effects across the planning area. Therefore, it is reasonable to assume that alternatives prescribing greater levels of multiple-use activities, such as Alternatives A and D, may

result in greater potential for negative impacts to wildlife species and key habitat components and may require additional project design and mitigation approaches, compared to Alternatives B and C.

The following sections discuss the anticipated environmental consequences related of implementing the proposed LRMP alternatives on terrestrial wildlife species, habitats, and key habitat components. The format of this analysis is based on species groups and related wildlife issues that occur within the planning area, and the various resource program areas that may influence them.

DIRECT AND INDIRECT IMPACTS TO SPECIES GROUPS

The species groups included in this section are analyzed relative to the program areas that may influence those groups. Some programs, such as air resources and the terrestrial wildlife program, are not included in the analysis because they would result in little to no ground disturbance; therefore, they would not be expected to measurably influence these species groups. The program areas and environmental consequences discussed for each alternative may vary for each species group.

Guidance included in the LRMP, relative to the desired conditions, objectives, referenced program direction, conservation plans, and standards and guidelines would apply to each species group. This guidance would assist in minimizing impacts, to various degrees, for each species group and is expected to provide the ecological components necessary to support sustainable populations of all terrestrial wildlife species that occur within the planning area.

Amphibians and Reptiles

Impacts Related to Influential Program Areas: Some program activities that may influence amphibian and reptile populations would continue to be addressed in activity planning and management. These program areas include livestock grazing, recreation travel, timber resources, fire and fuels, and solid and fluid minerals. Influences from these programs may vary, depending on their location and proximity to amphibian and reptile breeding and foraging habitats. The following are examples of program activities that may present concerns during project design.

- Timber harvesting may directly impact amphibians if it occurs in the vicinity of riparian areas and wetland ecosystems that function as breeding habitats.
- Solid minerals programs may impact amphibians or reptiles if they occur in or near stream areas or other riparian breeding habitats and areas used for breeding and foraging by reptiles.
- Acid-rock drainage has historically been associated with solid minerals extraction in some drainage areas. Currently, programs are underway to alleviate acidity problems and restore water quality, where possible.
- Fluid minerals programs may impact amphibians through accidental spills of chemicals, saline water, or petroleum at the well site, or through habitat fragmentation or other impacts associated with access roads.
- Livestock grazing that occurs within riparian areas or that influences upland habitat components may impact amphibians and reptiles.

Standards, guidelines, and other referenced guidance, including the Watershed Conservation Practices Handbook (Region 2 Supplement; USFS 2006a), the Conservation Plan and Agreement for the Management and Recovery of the Southern Rocky Mountain Population of the Boreal Toad (*Bufo boreas boreas*) (Boreal Toad Recovery Team and Technical Advisory Group 2001), Rangeland Standards and Guides (BLM Handbook 4180-1 and FSM 2200), and standards and guidelines from

Section 2.13 of the LRMP (Access and Travel Management) would be applied at the project level to address these site-specific concerns.

All of the alternatives may have potential negative, and positive, influence on amphibians and reptiles. Alternatives that emphasize more ground-disturbing activity in or near primary habitat areas for amphibians (including riparian areas and wetlands ecosystems) and upland reptile habitat may carry greater potential for impacts to these species groups. LRMP components would apply to all of the alternatives. These components, which would allow for the formulation and implementation of mitigation, stipulations, and/or other conservation measures for the species (as needed, on a site-specific basis) are expected to reduce the potential for site-specific impacts.

There would be little difference in projected outputs between alternatives for some programs that could influence amphibians and reptiles. For example, the projected outputs for fire and fuels, water/fish programs, and solid minerals would be similar under all of the alternatives. However, Alternatives D and A propose a substantial increase in acreage where timber harvest may occur, compared to Alternatives C and B. For livestock grazing, Alternative D projects substantially more AUMs and suitable acres on active allotments, with Alternatives A and B projecting relatively similar levels, and Alternative C projecting the fewest AUMs and suitable acres on active allotments. Land area available for active livestock management activities could impact amphibian and reptile habitats. For travel management, Alternatives B, C, and D would eliminate cross-country motorized use and reduce the areas available for designation of motorized routes in future travel management planning efforts. Eliminating cross-country motorized travel and limiting motorized travel to a system of designated routes would substantially reduce the potential for effects to amphibians and reptiles compared to the potential for disturbance in areas of unrestricted cross-country travel. The acreage identified as suitable for motorized travel on NFS lands and limited for BLM lands would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. For fluid minerals, acres available for leasing are fairly similar across Alternatives A, B, and D. Alternatives A, B, and D open the largest amounts of federal minerals to leasing. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. Under the No Leasing Alternative, development would be limited to existing leases within the planning area. Additional discussion concerning the fluid minerals program is found under the supplement section at the end of this Terrestrial Wildlife section.

Under all alternatives, potential impacts would be limited by implementation of LRMP components. However, the potential for habitat and species impacts and the potential need for management and monitoring of amphibians and reptiles and their habitats would be greatest under Alternative D because it has the highest projected level of outputs that could negatively impact habitats for amphibians and reptiles. Alternative C has the least projected outputs that could impact amphibian and reptile habitats. Potential negative impacts from outputs to amphibian and reptilian habitats would be similar under Alternatives A and B, which fall between the levels for Alternatives D and C. With effective implementation of LRMP standards and guidelines and applicable management direction from other referenced guidance, adverse impacts to amphibian and reptile habitats from LRMP implementation activities are expected to be generally minor and localized and are not expected to result in measureable changes to species abundance or distribution across the planning area.

Migratory Birds

Impacts Related to Influential Program Areas: Potential influences on migratory bird species that may occur within the planning area are addressed through project-level impact analysis, and relative potential effects from LRMP alternatives are described below. Management standards and guidelines

have been updated to reflect the latest available science and local information, and standards and guidelines would be applied to address potential concerns.

In general, the amount of habitat likely to be altered by projects conducted under LRMP implementation under any of the alternatives is expected to be relatively small when compared to the total amount of habitat currently available within the planning area. For this reason, and for most species, the impacts of direct habitat alteration on migratory birds would be generally small and not sufficient to result in population-level impacts or in changes to species distribution across the planning area. However, for some bird species associated with rare or unusual (e.g., mature cottonwood gallery forest) habitat components, it is possible that LRMP implementation actions that affect that particular rare or unusual habitat attribute could have locally more substantial impacts to a specific bird species. For all these reasons, impacts to species would vary under all of the alternatives. Impacts are likely to occur on nesting, migration, or wintering habitats (or some combination of habitats) depending on bird species and season of occurrence. For every action carried out under any LRMP alternative, some bird species may benefit from habitat alterations, some species may not be impacted at all, and some bird species may be negatively impacted. The degree of impact to migratory birds would differ depending on factors such as primary habitat association, effect to key habitat components, habitat generalist or specialist, and season of species occurrence.

Both timber and fire and fuels programs could be highly influential on habitats for migratory birds in some key groups (such as the snag-dependent group). Depending on the timing of timber and fuels management activities, these activities may result in beneficial or detrimental effects to various bird species. Long-term habitat impacts from these program areas may be both positive and negative, depending on the project type, habitat affected, previous management history, bird species involved, project design criteria applied, and other factors. Smaller program areas (including watershed/fisheries improvements, and wildlife habitat improvements) may influence multiple migratory bird species. Impacts, however, are expected to be very small and localized because projects are expected to be relatively short in duration and small in scale. Some of these projects may also provide potential long-term habitat improvement benefits for migratory bird species.

In response to EO 13186, the BLM developed an MOU with the USFWS to promote the conservation of migratory bird populations (BLM 2010b). The EO and the MOU require the BLM to ensure MBTA compliance, evaluate agency actions and plans for their potential impact on migratory birds, initiate actions to minimize impacts to migratory birds, and contribute to the conservation of migratory birds. The MOU provides suggestions for how the BLM could further bird conservation through the development of conservation measures to reduce or minimize impacts. To reduce or minimize impacts on the TRFO, activities would be restricted during local peak nesting activity, May 15 through July 15 annually. Areas may be inspected and cleared prior to project construction.

In response to EO 13186, the USFS also developed an MOU with the USFWS to promote the conservation of migratory bird populations (USFS 2008a). The MOU provides suggestions for how the USFS could further conservation of migratory bird populations and habitats by identifying and implementing strategies that promote bird conservation and avoid or minimize adverse impacts on migratory birds. The MOU focuses on bird populations and habitat restoration and enhancement where actions can benefit specific ecosystems and migratory birds dependent on those ecosystems, and recognizes that actions taken to benefit some migratory bird populations may negatively affect other migratory bird populations and that actions that may provide long-term benefits to migratory birds may also have short-term impacts on individuals. USFS land management actions conducted on the SJNF during LRMP implementation would consider this MOU and additional referenced

guidance listed in the LRMP to guide consideration of opportunities for actions that promote the conservation of migratory birds in the planning area.

The great variability in migratory bird species, key habitat components upon which migratory birds depend, and the variety of season of use and/or presence within the planning area indicates that all LRMP alternatives are likely to result in beneficial, neutral, and adverse effects to some migratory birds. The degree of impact and range of effects would depend on the bird species affected, the scope and scale of the project, and other factors. The degree and direction of impact would vary, depending on factors such as project type, application of project design criteria, the season of year projects are implemented, and general habitat type. Similar to other wildlife groups such as mammals, LRMP alternatives that would emphasize vegetation manipulation or ground-disturbing activities in program areas that occur in primary migratory bird habitats could carry a greater risk of causing higher and more negative impacts to more bird species. Effective implementation of LRMP direction during project implementation is expected to minimize impacts to migratory birds regardless of the selected alternative. LRMP direction includes a wide variety of direction that benefits bird conservation such as direction related to forest structural stages and canopy cover, riparian and wetland area enhancement, snag and downed log retention, and TL close to key nesting and roosting areas.

Impacts to migratory bird habitats are expected to be similar across all LRMP alternatives for those program areas that have similar projected program outputs, such as fire and fuels treatments. In general, the impacts of LRMP implementation are likely to be greatest under Alternative D and the least under Alternative C. Alternatives A and B are projected to have relatively similar potential for impacts to migratory birds. Depending on the species, LRMP implementation influences on migratory birds are expected to vary in intensity and over time. Under all alternatives, potential for impact and intensity of effect would be limited by implementation of LRMP components. Effective application of LRMP components is expected to sustain populations of migratory birds well distributed across the planning area under each of the alternatives.

Cavity Nesters and Snag-dependent Species: The potential direct and indirect impacts related to multiple-use programs on birds and other species (e.g., bats) dependent on tree cavities and standing snags for nesting, reproduction, or roosting, or as primary foraging substrate, may be widespread across the planning area. Potential impacts may be of minor to moderate levels, depending on the degree of public access for fuel wood harvesting, primary habitat type, topographical position of a snag, and a bird species' particular natural history requirements.

In general, potential impacts to snag-dependent bird species may be limited primarily to those program areas that cause or facilitate, directly or indirectly, the loss of standing snags, especially those snags greater than about 16-inch dbh (Bull et al. 1997; Parks et al. 1997; Schultz 2001). Standards and guidelines would protect and maintain standing snags, especially large-diameter snags (greater than about 16 inches dbh). In general, Alternative C would have the least potential for impacts to habitat components for snag-dependent birds, followed by Alternatives B, D, and A, respectively. This is based on the projected output amounts under each alternative for program areas that are likely to reduce the abundance or affect the distribution of snag habitats.

Examples of program areas that have the potential to reduce the abundance or distribution of large-diameter standing snags, or indirectly facilitate the loss of snags, include travel management, timber resources, fire and fuels, and solid and fluid minerals. Other activities, such as watershed/fisheries improvements, livestock grazing, and invasive plant species treatments, might also indirectly influence the distribution and/or abundance of large-diameter standing snags. However, the impacts related to these other activities are expected to be site-specific in nature and are likely to only impact

very small numbers of snags in very limited areas. For this reason, they are unlikely to result in impacts to population sustainability of snag-dependent birds across the planning area. Effects from these other program areas are expected to be so small and site-specific that they would not cause detectible changes in abundance or distribution of snag-dependent birds across the planning area.

Travel management, timber, and oil and gas projects that could develop new access or substantially improve existing access to areas that currently have higher densities of large-diameter standing snags (including riparian areas and ridge tops) may indirectly facilitate increased losses of snags to personal use firewood gathering. This potential impact would be likely to degrade habitat value for snag-dependent birds. Restricting on- and off-road motorized travel to designated routes across the SJNF and TRFO would likely protect existing snags, especially those large-diameter snags farther than 300 feet from roads, by reducing accessibility of snags that are farther than 300 feet from roads for personal use firewood harvesting. The SJNF is currently in the process of implementing USFS travel management regulations published in 2005. Under the 2005 travel management rule, motorized travel on NFS lands would be restricted to designated roads and motorized trails and cross-country motorized travel would generally be prohibited. This is expected to influence large areas, especially on the west side of the SJNF, that are currently open to cross-country motorized travel, and protect snags that are farther than 300 feet from roads from harvest for fuel wood by limiting cross-country motorized access.

Timber harvest and fire and fuels management projects are likely to result in the greatest potential for direct and indirect impacts to habitats for snag-dependent birds, compared to other agency program areas. Timber harvest may negatively impact snag-dependent birds by reducing snag densities through the removal of snags for safety of operations during timber harvest. However, standards and guidelines can reduce the potential for snag loss during timber harvesting activities. Standards and guidelines would be the same under all of the alternatives and are expected to protect and maintain large-diameter snags and increase recruitment of large-diameter replacement snags.

For snag-dependent birds associated with ponderosa pine habitats, warm-dry mixed conifer habitats, and spruce-fir habitats, Alternatives A, and B have similar projected timber program outputs. Alternative C has slightly less projected program outputs, and Alternative D has the most projected program outputs. For cool-moist mixed conifer habitats, Alternative C has the least projected program outputs, followed by Alternatives B, A, and D, respectively. For aspen-dominated habitats, Alternative C has the least projected program outputs, followed by Alternatives A, B, and D, respectively.

Prescribed burns are often used to treat understory hazardous fuel conditions and reduce slash following timber projects. Projected outputs for prescribed fire projects are expected to be similar across all alternatives. Prescribed fire is frequently used as a follow-up treatment in ponderosa pine and warm-dry mixed conifer stands, and often results in the loss of soft snags from flying embers catching in the crowns of large-diameter standing snags. Conversely, prescribed fire can also create new snags when burn intensities are high. However, because large-diameter trees (greater than 16 inches dbh) are less susceptible than small-diameter trees to being killed by prescribed fires conducted under normal burn parameters, most snags created by agency prescribed fires are too small to provide high-quality habitat for cavity-nesting birds. The small snags that are often created by prescribed fire are usually much smaller in diameter than the soft snags that are often lost during the burn, and therefore the net habitat value for snag and cavity-dependent birds generally declines following prescribed burns.

Fuel treatment project impacts to snag-dependent birds would depend primarily on maintaining and creating large-diameter ponderosa pine and Douglas-fir snags. Over the long term (more than 30 years), fuel treatment projects could result in higher rates of recruitment of large-diameter snags

because LRMP standards, guidelines, and desired conditions would favor the retention of large-diameter snag replacement trees and the restoration of ecosystem function (including disturbance processes, such as natural fire). Because there is little difference between the alternatives in the projected output acreage of fuel treatment projects, there may be little difference between the alternatives in potential program impacts to snag-dependent birds from fuel treatment projects.

Most fluid minerals development would likely occur in the ponderosa pine, pinyon-juniper, and warm-dry mixed conifer habitat types. Fluid minerals development may slightly reduce habitat quality for snag-dependent birds during the life of the LRMP, but the level of impact is expected to be minor to moderate, and the scale of impacts is expected to be localized and very small, depending upon habitat type, past management history, and degree of public access, both before and after project development.

Each alternative would have activities and activity objectives that could negatively impact snags used by cavity-nesting birds. Generally, Alternative A would have the greatest potential to reduce snag density and distribution. This is mainly due to Alternative A providing the largest acreage open to cross-country motor vehicle travel and opportunity areas where the transportation system could expand. Alternative C would have the least number of projected program outputs that could reduce snag density and distribution, followed by Alternatives B, then D, respectively. Implementation of LRMP components (as described above) designed to protect and maintain snag characteristics and distribution is expected to maintain sustainable populations of snag-dependent wildlife across the planning area under all alternatives.

Raptors: The potential impacts of LRMP alternatives in relation to raptors would be primarily associated with disturbance and/or habitat modification at or near nest sites or winter roost sites. Habitat modification could involve substantial changes to forest structural characteristics in important hunting habitats, structural improvements within close proximity to historically used nests when alternative nest options are unavailable, the loss of large standing snags that project above the surrounding forest canopy (super-canopy trees), along the forest edges that provide favored hunting perches, or the loss of atypical mature trees that provide sites for support of large and bulky stick nests. Under all LRMP alternatives, standards and guidelines would protect and maintain large-diameter snags, increase recruitment of replacement snags, improve hunting habitats by moving ecological conditions closer to those expected under HRV, and maintain and improve habitat conditions for the diversity of prey species that make up the diet of most raptor (e.g., recommendations of Reynolds et al. 1992). Examples of program areas that could result in modification of raptor habitats include travel management, timber resources, fire and fuels, recreation, lands, locatable minerals, and solid and fluid minerals.

Some raptor species are especially sensitive to disturbance and may suffer reduced productivity or abandon nests in response to human activity within close proximity (distances of 0.5 to 0.25 mile for many species) of nest sites during sensitive time periods. The degree of disturbance-related impacts would depend on the species of raptor affected, type of activity, and the timing and duration of the activity in relation to raptor reproductive status. Raptor response to disturbance can be modified (positively or negatively) by site-specific conditions such as topographic screening, forest vegetation type and density, cliff structure, nature and duration of historic human activity patterns, and road and trail access.

Raptor nesting areas tend to be used regularly and predictably for many successive years. For this reason, conservation of raptor populations is often approached through the application of timing restrictions and buffer distances around known historic nesting sites to prevent those sites from becoming unusable due to excessive disturbance during key nesting seasons. The CPW developed

species-specific recommendations for timing restrictions and buffer distances around raptor nesting and winter roost sites (CPW 2008). These recommendations have been adopted by the SJNF and TRFO, with some minor changes due to local conditions and site-specific knowledge. With the application of project standards and guidelines, impacts related to management activities in project areas are expected to be limited in scope and small in scale, and therefore are not expected to cause detectible changes in raptor abundance or distribution across the planning area. LRMP direction includes fluid mineral leasing stipulations, Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors (CPW 2008), Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992), Utah Field Office Guidelines for Raptor Protection from Human and Land Use Disturbances (Romin and Muck 2002), and the most recent recovery plan for the Mexican Spotted Owl (USFWS 1995, 2012c).

Impacts to habitats for raptor species are expected to be similar across all LRMP alternatives for those program areas that have similar expected annual outputs, such as fire and fuels treatments. In general, the impacts of LRMP implementation are likely to be greatest under Alternative D because this alternative projects the greatest number of program outputs that could change habitat components for raptors. Alternative A may have a similar magnitude of impacts to Alternative D due to disturbances from having the largest area open to cross-country motor vehicle use and the largest areas of suitability where the transportation system could expand. Alternative B would have fewer outputs associated with impacts, compared to Alternatives D and A, and Alternative C would have the least outputs and therefore would be expected to have the least potential for impacts to habitats for raptor species. Effective application of LRMP components (as described above) is expected to sustain raptor populations well distributed across the planning area under each of the alternatives.

Wildlife Issues Related to Migratory Birds

Impacts Related to Disturbance and Habitat Effectiveness: To address the migratory bird management challenges discussed under Section 3.3.2 above, LRMP direction (desired conditions, objectives, standards, and guidelines; see Volume II, LRMP, Table 2.3.2) was developed to maintain or improve habitat conditions around raptor focal sites, including historically used platform nests, cliff complexes, and winter roost tree stands. Because LRMP direction does not vary by alternative, projects would be required to consider impacts to historically used raptor focal sites, regardless of the selected LRMP alternative.

A variety of LRMP implementation activities could occur in close proximity to raptor focal sites on the SJNF and TRFO, including vegetation management (fuels reduction projects and timber harvest) activities, developed and dispersed recreation (motorized and non-motorized) activities, habitat improvement activities, livestock grazing, minerals development activities, permitted outfitter and guide operations, special use permits for access to interspersed private lands, and utility ROWs. All of these activities are expected to continue, to varying extents, under all alternatives under the new LRMP.

Acres of federal minerals available for leasing are fairly similar across Alternatives A, B, and D, which open the largest amounts of federal minerals to leasing. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. For timber harvest activities, Alternative C proposes the fewest acres of timber harvest, followed by Alternatives A and B, which project the same acres of timber harvest, then by Alternative D, which projects the most timber harvest activities. Timber harvest activities may cause temporary impacts to individual raptors and adverse impacts to nests and foraging cover, as well as disturbance in harvest activity areas. Restoration treatment, however, may be beneficial in the mid- to long term (5–10 years) by improving habitat conditions for prey species, thereby improving raptor foraging conditions. For fuels treatments

(mechanical and prescribed fire), there is little difference between the LRMP alternatives in projected activity outputs. Temporary impacts to individual raptors may occur during project implementation, more so for mechanical projects than prescribed fire projects, but long-term effects on raptor foraging habitats are expected to be primarily beneficial through the improvement of prey habitats. For motorized recreation, the acreage identified as suitable for motorized travel on NFS lands and limited for BLM land would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. Alternative B, C, and D would limit motorized travel to designated routes, substantially reducing the area on the SJNF and TRFO where there is potential for disturbance to raptor nests and winter roost sites. The projected activity levels of permitted outfitter and guide operations, special use permits for access to interspersed private lands, and utility ROWs are not expected to vary by LRMP alternative. All are expected to continue under LRMP implementation.

For all alternatives and actions across the SJNF and TRFO, Alternative C has the greatest potential to maintain habitat effectiveness at and near historic raptor nest and winter roost sites, followed by Alternatives B, D, and A, respectively. As stated above, effective application of LRMP components is expected to sustain raptor populations across the planning area under all alternatives.

Impacts Related to Increasing Mature and Old Growth Ponderosa Pine and Warm-dry Mixed Conifer Forests: Ponderosa pine and warm-dry mixed conifer forests on the SJNF and TRFO are thought to differ substantially from HRV conditions in terms of vegetation stand structure and fire frequency. In particular, ponderosa pine and warm-dry mixed conifer forests have substantially fewer acres in old growth and in the old growth development stage than would be expected under HRV. A goal of LRMP direction is to restore fire-adapted ecosystems to conditions more similar to those found under HRV and to better incorporate disturbance processes from which HRV conditions developed. For wildlife species associated with and/or dependent upon the habitat structural attributes and forest conditions most commonly found in old growth and old growth development stages, there is less habitat availability and capability today than would be expected under HRV conditions. Increasing the abundance and distribution of these stands, as well as increasing the role of historic disturbance processes in stand-level dynamics, is expected to move ponderosa pine and warm-dry mixed conifer forests towards conditions more similar to those expected under HRV. This is expected to improve and expand the amount and capability of habitats for wildlife species, including many bird species, associated with characteristics more commonly found in old growth and old growth development stages of ponderosa pine and warm-dry mixed-confer forests.

LRMP implementation activities most likely to influence stand conditions in ponderosa pine and warm-dry mixed conifer forests are oil and gas development, fuels treatments (mechanical and prescribed fire), and timber management activities. Acres of federal minerals available for leasing are fairly similar across Alternatives A, B, and D. Alternatives A, B, and D open the largest amounts of federal minerals to leasing. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. Under the No Leasing Alternative, development would be limited to existing leases within the planning area. For timber harvest, Alternative C projects the fewest acres of timber harvest in ponderosa pine and warm-dry mixed conifer forests, followed by Alternatives A and B which project the same acres of timber harvest, followed by Alternative D, which projects the most timber harvest in ponderosa pine and warm-dry mixed conifer forests. For fuels treatments (mechanical and prescribed fire), there are no differences between the LRMP alternatives in projected activity outputs in ponderosa pine and warm-dry mixed conifer forests. Timber harvest activities may cause some temporary impacts to wildlife individuals in harvest activity areas, but

restoration treatments are expected to be beneficial in the mid- to long term (5–10 years). Because Alternative D projects the most acres of restoration harvest in ponderosa pine and warm-dry mixed conifer forests, Alternative D could result in the most rapid movement towards conditions expected under HRV, compared to Alternatives A, B, and C. Conversely, Alternative C could result in the greatest long-term movement towards HRV conditions because this alternative proposes the greatest acreage within protected areas (RNAs and old growth recruitment areas for the USFS, ACECs for the BLM), followed by Alternatives B, D, and A, respectively.

Within the LRMP, direction (desired conditions, objectives, standards and guidelines) designed to maintain or enhance conditions most commonly found in old growth and old growth development stages would be the same across all alternatives. For this reason, LRMP implementation under all alternatives is expected to move conditions in ponderosa pine and warm-dry mixed-confer forests closer to those expected under HRV, thereby improving habitat capability for resident and migratory bird species associated with and/or dependent upon the habitat structural attributes most commonly found in old growth and old growth development stages.

Impacts Related to Maintaining or Improving Riparian Areas, Wetlands, Springs, and Seeps: A wildlife management challenge is to maintain or improve habitat capability for wildlife species closely associated with riparian areas, wetlands, and spring and seep habitats. Although small in extent, riparian areas, wetlands, and spring and seep habitats represent very important ecological components of the SJNF and their importance as habitats for migratory birds far exceeds the relatively small area these water-dependent features occupy on the landscape. In response to this management challenge and wildlife habitat improvement opportunity, standards and guidelines were developed in several areas of the LRMP to provide for maintaining and improving water quantity, water quality, and hydrologic function of surface water and associated water-dependent features.

LRMP implementation activities most likely to affect riparian areas, wetlands, and spring and seep habitats include timber harvest, mechanical fuels treatments, oil and gas development, livestock grazing, recreation, and minerals development. The degree of impact from management activities would likely depend on the size, timing, frequency, and duration of the activity, as well as mitigation measures applied at project implementation. The degree of impact from management activities would also likely depend on the elevation and location of the water-dependent feature because a larger proportion of these features at higher elevations on the SJNF and TRFO are located in protected areas such as wilderness and wilderness study areas, compared to water-dependent features located at lower elevations. For this reason, LRMP implementation activities are less likely to affect habitat capability for bird species that are closely associated with water-dependent features located at higher elevations, as compared to bird species associated with riparian and water-dependent features at lower elevations.

Indirect impacts from timber harvest and mechanical fuels treatment activities to habitat capability for bird species closely associated with riparian areas, wetlands, and spring and seep habitats could occur under all LRMP alternatives, but direct project activities are less likely to occur within the features themselves because of protective standards and guidelines. Impacts would most likely occur in surrounding upland areas, with indirect effects to bird species and habitat capability. Alternative C projects the fewest acres of timber harvest activities, followed by Alternatives A and B which project nearly the same acres of timber harvest, followed by Alternative D which projects the most timber harvest activities. For mechanical fuels treatments, Alternative D projects the most activities, with the same level of activity projected under Alternatives A, B, and C. There are no differences between the LRMP alternatives in projected activity outputs for prescribed fire activities.

Impacts from solid minerals development to bird species associated with riparian areas, wetlands, and spring and seep habitats would be similar under all alternatives because the projected activity levels would be similar under all alternatives. Impacts from fluid minerals development would occur to some extent under all alternatives. Acres of federal minerals available for leasing are fairly similar across Alternatives A, B, and D. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. Under the No Leasing Alternative, development would be limited to existing leases within the planning area. Because Alternative A projects the most acres of disturbance on leased and unleased lands it has the greatest potential for impacts to bird habitats associated with water-dependent features, followed by Alternatives D, B, and C, respectively. Alternatives A, B, and C offer the greatest protection to water-dependent features because more stipulations that apply are NSO. Alternative D offers the least protection to water-dependent features because more stipulations that apply are CSU.

The potential for impacts from livestock grazing activities to bird species associated with riparian areas, wetlands, and spring and seep habitats would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. Under Alternative D, livestock management may need to be more intensive and may require more investments in range improvements (including fencing, vegetation manipulation, and water developments) to avoid or otherwise mitigate potential impacts to resources such as riparian areas, wetlands, and spring and seep habitats. Alternative C would provide the most opportunity to remedy livestock grazing conflicts with other resources, because livestock grazing would occur on fewer acres and stocking rates would be lower than under any other alternative.

For motorized travel, Alternative A would have the greatest potential for impacts to bird species associated with riparian areas, wetlands, and spring and seep habitats because it is the only alternative that would allow cross-country motorized travel off of designated routes. Alternatives B, C, and D would restrict motorized travel to designated routes. The acreage identified as suitable for motorized travel on NFS lands and limited for BLM land would be greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. Assuming that LRMP alternatives providing the greatest opportunities for motorized routes could also have the greatest potential for motorized travel impacts to riparian areas, wetlands, and spring and seep habitats, then the greatest potential for impacts to water-dependent features could occur under Alternative A, followed by Alternatives D, B, and C, respectively.

Invertebrates

Impacts Related to Influential Program Areas: The primary invertebrate species of conservation concern within the planning area include the Uncompahgre fritillary butterfly and the Nokomis fritillary butterfly (also known as the Great Basin silverspot butterfly). The Uncompahgre fritillary butterfly is a federally endangered species that occurs in select high alpine habitats and is only known to occur in one small site within the planning area. Other small potential Uncompahgre fritillary butterfly habitat areas may exist in the planning area but, after at least 9 years of intensive inventory, no additional suitable sites have been found. Additional discussions about effects to Uncompahgre fritillary butterfly and its habitat are found below under the Threatened and Endangered Terrestrial Wildlife Species section.

Other than possible illegal collections, there are few activities that would potentially impact Uncompahgre fritillary butterfly colonies or their habitats under any of the alternatives. Standards and guidelines, including other referenced guidance such as the species' recovery plans provide direction that is expected to minimize and mitigate potential impacts to Uncompahgre fritillary butterfly populations from program implementation. These standards and guidelines would be the same under all of the alternatives and would ensure that Uncompahgre fritillary butterfly habitats would be maintained in the planning area.

The Nokomis fritillary butterfly is a distinct species in the genus *Speyeria* that has been documented as occurring within the planning area. It is primarily associated with moist meadows and riparian areas where its host plant—northern bog violet—is available on which to lay eggs. The eggs over-winter prior to the next development stage, with flight generally occurring from late July through mid-September. Nectar sources primarily involve thistle species.

Potential impacts on the Nokomis fritillary butterfly related to LRMP implementation are expected to be similar to those described previously for fish and amphibians. Project activities that may impact riparian areas, springs/seeps, and streamside zones are especially important. This is because these areas provide habitat for the host plant and for the development of young butterflies and eggs. Potentially influential program areas include livestock grazing, travel management, timber resources, fire and fuels, and solid and fluid minerals. Programs such as watershed/fisheries improvements and invasive plant species treatments may also pose short-term risks of impact, while at the same time offering potential long-term habitat improvement benefits.

All alternatives have the potential to influence habitat conditions for the Nokomis fritillary butterfly. The alternatives that project greater potential for ground-disturbing activity in or near riparian areas that could support northern bog violet could be expected to have a greater potential for impact to this species. As described above in the wildlife issue section related to maintaining or improving conditions of riparian areas, wetlands, springs, and seeps for birds, LRMP components are intended to reduce potential impacts and sustain ecological conditions of water-dependent features. These LRMP components would allow for the formulation and implementation of mitigation, contract stipulations, and/or other conservation measures for the benefit of species associated with water-dependent features such as the Nokomis fritillary butterfly on a site-specific basis.

As described above in the wildlife issue section related to maintaining or improving conditions of riparian areas, wetlands, springs and seeps for birds, LRMP implementation activities most likely to affect habitats for the Nokomis fritillary butterfly include timber harvest, mechanical fuels treatments, oil and gas development, livestock grazing, recreation, and minerals development. The degree of impact from management activities would likely depend on the size, timing, frequency, and duration of the activity, as well as mitigation measures applied at project implementation.

Indirect impacts from timber harvest and mechanical fuels treatment activities to habitat capability for Nokomis fritillary butterfly could occur under all LRMP alternatives, but direct project activities are less likely to occur within water-dependent features themselves because of LRMP design components. Impacts would most likely occur in surrounding upland areas, with indirect effects to the butterfly's host plant and habitat capability. Alternative C projects the fewest acres of timber harvest activities, followed by Alternatives A and B, which project nearly the same acres of timber harvest, followed by Alternative D, which projects the most timber harvest activities. For mechanical fuels treatments, Alternative D projects the most activities, with the same level of activity projected under Alternatives A, B, and C. There are no differences between the LRMP alternatives in projected activity outputs for prescribed fire activities.

Impacts from solid minerals development to Nokomis fritillary butterfly habitat would be similar under all alternatives because the projected activity levels would be similar under all alternatives. Impacts from fluid mineral development would occur to some extent under all alternatives. Acres of federal minerals available for leasing are fairly similar across Alternatives A, B, and D. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. Under the No Leasing Alternative, development would be limited to existing leases within the planning area. Because Alternative A projects the most acres of disturbance on leased and unleased lands it has the greatest potential for impacts to butterfly habitats and water-dependent features, followed by Alternatives D, B, and C, respectively. Alternatives A, B, and C offer the greatest protection to water-dependent features because more stipulations that apply are NSO. Alternative D offers the least protection to water-dependent features because more stipulations that apply are CSU.

The potential for impacts from livestock grazing activities to Nokomis fritillary butterfly habitat would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. Under Alternative D, livestock management may need to be more intensive and may require more investments in range improvements (including fencing, vegetation manipulation, and water developments) to avoid or otherwise mitigate potential impacts to resources such as riparian areas, wetlands, and spring and seep habitats. Alternative C would provide the most opportunity to remedy livestock grazing conflicts with other resources, because livestock grazing would occur on fewer acres and stocking rates would be the lower than under any other alternative.

For motorized travel, Alternative A would have the greatest potential for impacts to Nokomis fritillary butterfly habitat because it is the only alternative that would allow cross-country motorized travel off of designated routes. Alternatives B, C, and D would restrict motorized travel to designated routes. The acreage identified as suitable for motorized travel on NFS lands and limited for BLM land would be greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. Assuming that LRMP alternatives providing the greatest opportunities for motorized routes could also have the greatest potential for motorized travel impacts to riparian areas, wetlands, and spring and seep habitats, then the greatest potential for impacts to water-dependent features could occur under Alternative A, followed by Alternatives D, B, and C, respectively.

Mammals

Impacts Related to Influential Program Areas: The vast differences in life history and habitat requirements among the mammal species that inhabit the SJNF and TRFO suggest that mammal species may be influenced by management actions and/or by human activities in widely differing ways and to different extents. A variety of impacts that could vary greatly in intensity are expected during LRMP implementation, resulting in widely varying potential impacts on the mammal group as a whole. Influences from resource programs would vary depending on many factors such as project location and proximity to important habitat components, timing of project implementation in relation to important life history functions, duration of project implementation, and degree to which key habitat attributes for mammal species are affected by the Proposed Action. The anticipated direct and indirect effects from LRMP alternatives on big game, fur bearers and carnivores, bats, and other mammal species are summarized below.

Program areas that may have the greatest potential influence on most members of the mammal group include livestock grazing, timber, fire and fuels, recreation, lands and special uses, and fluid minerals (see Sections 3.7, 3.9, 3.11, 3.14, 3.18, and 3.19). Other program areas such as watershed/fisheries, invasive plant species management, and wildlife habitat improvement projects may also influence mammals at smaller and more local scales. Wildlife habitat improvement projects anticipate completing some terrestrial habitat improvements each year, depending on the selected alternative. This may influence some mammal species, depending on the type of habitat and habitat targeted. Depending on location and timing, all of these habitat improvement programs may result in potential short-term impacts, but are expected to also have long-term habitat improvement benefits.

Activities implemented by the timber, fire, and fuels programs would result in both positive and negative effects to mammals depending on scale, location, treatment method, treatment period, and other factors. The primary goal of these programs is to conduct vegetation treatment to achieve a variety of resource objectives. Treatments generally involve the use of mechanical equipment that manipulates vegetation structure and species composition. Mammals and other wildlife species respond to changes in vegetation structure and species composition, as well as human disturbance associated with these actions. The degree to which these actions affect habitat capability and mammal populations depends on the effects treatments have on preferred habitats used for foraging, breeding, and security. Many carnivores and furbearers are wide-ranging species that utilize topographic features and vegetative conditions as habitat and movement corridors, and therefore can be influenced by timber management and other programs that impact landscape connectivity through changes in vegetation structure and composition. Use of LRMP components and referenced documents and manuals should ensure that all three programs are capable of providing substantial short- and long-term benefits to some mammal species, such as big game animals, through projects that restore habitat quality and increase the quantity within high-use habitat areas.

Some fuel reduction projects, controlled burns, and timber projects are expected to have minor short-term (less than 5 years) negative effects from disturbance, but also result in long-term overall improvement in wildlife forage capacity, resulting in long-term improvement in habitat conditions for big game animals, especially those conducted on winter ranges and production areas. A potential negative effect of habitat improvement projects is loss of dense hiding cover located along motorized routes and in production areas, which could cause short- and long-term increases in human disturbance in proximity to designated routes within project areas, thereby increasing the exposure of animals to hunter harvest and potentially reducing use of those areas by big game animals (Montgomery et al. 2012).

Effects to mammals from lands/special uses and recreation programs are generally similar to other land management activities. Effects to habitat include loss of habitat important components through removal of vegetation and structural attributes such as snags and downed woody debris. Other potential effects to habitat include habitat modification (of vegetation, soil, or water) and pollution (habitats contaminated with foreign materials). Effects to species include exploitation (hunting, trapping, or collection) and disturbance that could be intentional (harassment) or unintentional (displacement). Other potential effects to species include collisions with motor vehicles and subsequent injury or mortality. The most influential impact to mammal species lands/special uses and recreation programs is activities associated with both programs to reducing habitat effectiveness through the indirect effects of human disturbance, causing individual animals to be displaced from preferred habitats to areas of lesser habitat capability or reduced security. The degree to which human disturbance affects mammals and other wildlife species is dependent on the type, intensity, and timing of human use/activity in relation to important animal life functions, and location of human activity in relation to key habitat attributes. The intensity of response by affected animals also

depends on the species in question and proximity to habitat available for dispersal when disturbances exceed the species' tolerance. In general, application of LRMP components, referenced guidance, and BMPs is expected to ensure that impacts to mammals from activities conducted by these program areas would be minor to moderate, limited in scale in relation to requisite habitats, and limited in duration to minimize impacts during times of important life functions.

Effects to mammals and their habitats from livestock grazing are primarily associated with or influenced by permitted livestock numbers and class, timing and duration of grazing, distribution of livestock, type of grazing system used, and operational techniques used to improve distribution and maintain or improve rangeland conditions. Grazing can influence mammal habitats by modifying plant biomass, species composition, and structural components such as vegetation height and cover used by mammal species for forage and/or cover. Other effects may include gradual reductions in the amount and quality of available forage. Forage competition between domestic livestock and ungulate big game species may influence the distribution and abundance of wildlife in some areas and in some seasons, such as during drought years. Invasive plant species such as noxious weeds may be introduced and expand into previously disturbed and undisturbed areas, affecting forage and cover for some mammal species. Operational effects may result from fence construction, water developments, and herding operations, which all have potential to affect movement and dispersal of mammals both positively and negatively. With proper design and installation, many of the operational strategies to manage livestock distribution can enhance habitat for mammals and other wildlife. Other potential beneficial effects associated with livestock grazing include improvement in plant vigor, thereby increasing forage quantity and quality for herbivorous and omnivorous mammals. Use of LRMP standards and guidelines and referenced documents and manuals should ensure proper rangeland management and minimal effects to mammals and terrestrial ecosystems.

Potential impacts to mammals from influential programs areas may be reduced, or increased, by the current trends associated with land ownership patterns and development of adjacent private lands. Presently, the human population is growing, and many ranches and other undeveloped private land that provided substantial amounts of wildlife security habitats are being developed into residential subdivisions, reducing their value to mammals and increasing the importance of adjacent federal lands to the long-term sustainability of mammal populations. Development of adjacent private lands would primarily impact big game animals that traditionally winter at lower elevations in a matrix of federal and private land ownerships; however, other mammal species may also experience impacts as other human activities (including from recreation, traffic, and infrastructure) also increase. Development of adjacent private lands has resulted in additional need for public lands to support big game populations on a limited amount of available winter range.

Within the planning area, the variability of mammal species types and habitats suggests that all alternatives have potential to affect mammal species. Effects are expected to be both negative and beneficial, depending on the species affected. As with other species groups, LRMP alternatives that emphasize more ground-disturbing activity in or near primary mammal habitat areas (such as production areas and limited winter ranges) would have a greater potential for impact to some mammal species or increase the intensity of impacts to some mammal species. The potential for influential impacts and disturbances would vary widely among mammal species. LRMP implementation activities that occur in close proximity to active breeding and young-rearing areas, and other important habitats such as winter ranges would be more likely to have impacts of greater intensity and on a wider variety of mammal species. Application of LRMP standards and guidelines and referenced documents and manuals during project design and implementation should ensure that the scale of impact is minimized and the intensity of effects is reduced to the extent possible. In general, the distribution of habitat components and habitat diversity across the planning area would

be guided by land capability and HRV. The habitats would vary somewhat in distribution, depending on output implementation under the alternatives. Implementation of LRMP components resulting in landscape linkage zone development, forest structural stage and canopy cover management, retention of snags and downed woody debris, and denning site protection would also benefit mammal species.

In summary, potential impacts to mammals are expected to be similar under all alternatives for some influential program areas because the outputs would be similar. For example, all alternatives contain direction for considering seasonal wildlife closures in important big game production and wintering areas, when necessary, to maintain habitat effectiveness for animals during important seasons. Existing winter closures of the BLM’s Grandview Ridge and Animas City Mountain properties designed to maintain habitat effectiveness for wintering big game animals would remain under all alternatives. Closure implementation would not vary based on the alternative selected. Closures to public entry could be implemented at any time between December 1 and April 30, based on snow conditions and animal distribution, in consultation with CPW. Closures would be lifted based on snow conditions on north-facing slopes and the surrounding areas, presence of big game animals, and coordination with CPW. Conditions based closures are reactive to weather conditions and may not be implemented in time to provide adequate protection for wintering elk. However, mule deer and elk attempting to migrate prior to initiation of a closure could be displaced or experience repeated disturbance inside the high use recreation areas, such as Grandview Ridge and Animas Mountain. Displacement and disturbance could lead to reduced body condition due to less favorable habitat condition outside of preferred range.

The potential for impact, as well as the need for adjustment and monitoring of project effects to some mammal species and their habitat components, is likely to be greatest under Alternative D. Impacts to mammals is likely to be least under Alternative C and likely to be similar between Alternatives A and B. The differences would be due to the slight acreage increase in potential outputs under Alternative D in relation to the number of acres available for timber harvesting, the available livestock AUMs, fluid minerals development scenarios, and the substantial increase in acres suitable for summer motorized travel. Alternative D would also have a larger amount of land area available for active management activities that may, in turn, impact mammal habitats, movements, and human disturbance. Use of LRMP standards and guidelines and referenced documents and manuals should ensure that habitats are available sufficient to support CPW population objectives and management goals for big game and other game species.

Wildlife Issues Related to Mammals

Impacts Related to Disturbance and Big Game Habitat Effectiveness: Big game winter ranges and production areas are important habitats for maintaining big game populations on the SJNF and TRFO. Roads are one of the most pervasive impacts of human development on wildlife, and their greatest impact is the indirect effects of habitat fragmentation and avoidance by wildlife (Hebblewhite 2008; Lyon and Christensen 2002; Rowland et al. 2005). The presence of roads and trails open to motorized use has been shown to reduce habitat effectiveness for big game animals (Hebblewhite 2008; Lyon 1983; Priesler et al. 2006). Rowland et al. 2000; Rowland et al. 2005). Traffic on roads reduces wildlife habitat effectiveness by influencing animal distribution, habitat use, and survivorship (Rowland et al. 2005). OHV routes have been shown to have similar effects on elk to those of open roads (Priesler et al. 2006). Increased human activity, especially that associated with increased motorized access, impacts wildlife habitats, alters animal distribution patterns, and reduces wildlife habitat effectiveness. Managing the impacts of motorized access, and the impacts from the wide variety of human activities and disturbances facilitated by that access, on winter ranges and

production areas is important for maintaining long-term habitat capability for big game species on the SJNF and TRFO.

Effects of motorized access on wildlife can be more pronounced in limited wildlife habitat areas such as winter concentration and production areas where animals are more concentrated, are often in reduced body condition, and have fewer opportunities to move away from disturbance to more secure areas. Some studies have shown that other factors such as season of motorized use, amount of motorized use (i.e., traffic volume) and pattern of motorized use (i.e., time of day) are additional factors that can influence (increase or reduce) the degree of impact of motorized use on big game animals and their distribution throughout available habitat areas (Montgomery et al. 2012; Rowland et al. 2005;). Road closures and/or use limitations have been shown to reduce the impacts of roads and traffic on wildlife and minimize the negative impacts of human activities on wildlife habitat effectiveness (Cole et al. 1997; Montgomery et al. 2012; Priesler et al. 2006; Sawyer et al. 2009).

At present, the amount, distribution, capability, and effectiveness of big game winter range habitats on the SJNF and TRFO are believed to be sufficient to meet CPW's big game population objectives. There is growing concern, however, that if declines in big game habitat effectiveness continue, that some big game habitat areas may no longer be capable of supporting the number of animals sufficient to meet CPW's population objectives for some big game herds.

The density of motorized routes (roads and trails open to motorized vehicles) varies widely across the SJNF and TRFO, and also within designated big game production areas and winter ranges. Some portions of the planning area have extensive designated and user made (i.e., unauthorized) motorized routes within areas mapped by CPW as deer or elk winter ranges, while other portions of the planning area have limited motorized routes or have applied site-specific mitigations to designated routes for the purpose of maintaining wildlife habitat effectiveness during specific seasons of the year.

In the revised LRMP, planning components have been developed for both the SJNF and TRFO to consider the density of routes open to motorized use, especially when projects are proposed in winter range and production areas. LRMP direction would apply to all alternatives, and effective application of LRMP direction is expected to maintain wildlife habitat effectiveness within CPW mapped big game winter ranges and production areas. Analysis of the impacts of management actions on big game habitat would be evaluated at the project level in a separate but related process, travel management planning. Both the SJNF and TRFO have been conducting and would continue to conduct travel management planning for site-specific project areas. During travel management planning, site-specific detailed analyses are conducted of roads and motorized trails that would be designated as open, closed, or restricted through the application of site-specific mitigations (such as TL). Potential impacts to wildlife from the designation of individual motorized routes would be considered during this process as site-specific transportation plans are developed for local networks of designated motorized routes.

In big game winter range areas where motorized route densities currently exceed LRMP direction, and where additional roads or motorized trails are proposed, seasonal restrictions or other mitigation measures could be applied during project-level LRMP implementation, if needed, to maintain or improve wildlife habitat effectiveness. Site-specific analysis would determine whether individual routes caused concern for wildlife habitat effectiveness, and what, if any, mitigation options would be most appropriate for addressing those concerns.

In general, Alternative A would maintain current OHV and travel direction on USFS and BLM lands. Under current management, cross-country travel is allowed on most TRFO lands and some SJNF

lands. On TRFO lands under Alternative A, large areas in the Gypsum Valley and Disappointment Valley areas would remain open to cross-country motorized travel, and the system of unmanaged motorized routes could continue trending upward and therefore continue to cause reductions in big game habitat effectiveness in some areas. On NFS lands, motorized travel is limited to designated routes, except where specifically authorized or allowed by a travel management plan decision. The SJNF has completed travel management planning on more than half of its planning area, as well as closing cross-country motorized travel on the remainder of the SJNF through a special order. However, the system of designated motorized routes on the SJNF could experience some growth on the remaining portion of the SJNF that has not yet completed travel management planning, and therefore some additional reductions in big game habitat effectiveness are possible in those areas under Alternative A.

In general, Alternatives B, C, and D would provide greater protection to big game winter ranges and production areas than Alternative A by eliminating cross-country motorized use on both SJNF and TRFO lands, with the exception of 23 open acres on TRFO lands. Eliminating cross-country motorized travel and limiting motorized travel to a system of designated routes would substantially reduce the potential for disturbance to big game animals, compared to the potential for disturbance in areas of unrestricted cross-country travel. It is possible, however, that in areas where terrain or other physical features have naturally limited cross-country motorized travel, the designation of existing routes and creation of new designated routes, along with installation of signs and maintenance of designated routes, there is potential to increase use on advertised designated routes, thereby increasing the potential for disturbance to animals and reducing habitat effectiveness along those routes. Even with the potential for increased use along designated routes, the overall improvement in big game habitat effectiveness from prohibiting cross-country motorized travel would likely greatly exceed the negative effects of increased traffic volume along advertised designated routes.

The acreage identified as suitable for motorized travel on SJNF lands and limited on TRFO lands would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on SJNF lands and open areas on TRFO lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. Alternatives A and D propose similar miles of road construction and reconstruction, more miles than under Alternatives B and C, and therefore would be less likely to maintain wildlife habitat effectiveness. Alternatives B and C would propose slightly fewer miles of road construction and reconstruction, and therefore would be more likely than Alternatives A and D to maintain wildlife habitat effectiveness. For all alternatives and actions across the SJNF and TRFO, Alternative C has the greatest potential to maintain big game habitat effectiveness, followed by Alternatives B, D, and A, respectively.

Impacts Related to Physical Fragmentation of Key Wildlife Habitats: LRMP implementation activities most likely to result in additional fragmentation of important wildlife habitats on the SJNF and TRFO are road construction, motorized trail and utility corridors, access ROWs, vegetation management projects, and mineral development. The capability of wildlife habitats that surround these project areas has declined due to past activities, and this trend is expected to continue for the foreseeable future and the duration of LRMP implementation. The potential for fragmentation impacts is expected to be greatest for wildlife habitats that are at lower elevations, adjacent to existing major highways and utility corridors, are in areas that are necessary to cross for infrastructure that connects communities across the SJNF and TRFO, and especially for habitats that are naturally limited in size by topography or vegetation such as winter ranges, parturition areas, and wildlife travel corridors.

The potential increase in habitat fragmentation (negative impacts) to existing wildlife habitats and the degree of impact from potential program outputs is likely to be minor to moderate impacts of short to moderate duration (less than 10 years) for program areas such as fire and fuels vegetation management projects. These projects may also have long-term positive impacts for some wildlife habitats, such as big game winter ranges and travel corridors. The degree of potential impact to wildlife habitats from program areas such as fluid minerals development, road construction and reconstruction, motorized trail and utility corridors, and access ROWs is likely to be of long duration (for the life of the LRMP) or permanent. These activities, however, are likely to represent only relatively small losses in total acreage of wildlife habitats but be of moderate or greater overall impact due to expected long-term indirect and cumulative impacts, especially where linear development corridors intersect limited wildlife habitats, such as winter ranges and travel corridors and riparian areas.

There are little differences between the alternatives in projected program outputs for mechanical fuels treatment and prescribed fire vegetation management projects. These project areas are expected to have both potentially positive (long-term) effects to wildlife habitat, such as improvements in big game forage capability, and negative (short-term) effects to wildlife habitats, such as temporary loss of vegetation structure, hiding cover, and human disturbance during project implementation.

For motorized travel suitability, potential for road construction and reconstruction, fluid minerals development, and suitable acres for timber production, Alternative C has the lowest projected potential program outputs and therefore would be expected to result in the lowest potential for additional fragmentation of existing wildlife habitats. Alternative B would have somewhat higher projected program outputs than Alternative C and therefore would be expected to result in a somewhat higher potential for fragmentation of existing wildlife habitats. Alternatives A and D are almost identical in potential projected program outputs, but would have the highest projected outputs and therefore would have the greatest potential for additional fragmentation of existing wildlife habitats, but there would be little difference between these alternatives in the relative degree of impact to wildlife habitats. Regardless of the alternative selected, use of LRMP standards and guidelines and referenced documents and manuals should ensure that habitats are available sufficient to support CPW population objectives and management goals for big game and other game species.

Impacts Related to Improving the Amount (NFS lands) and Condition (BLM and NFS lands) of Sagebrush Shrubland Habitats: A variety of LRMP components were developed to maintain or improve habitat conditions in sagebrush shrublands. Maintaining and improving habitat conditions in sagebrush shrublands is especially important in mule deer winter habitat areas mapped by CPW. Management direction is intended to maintain and improve ecological function of sagebrush shrublands thereby maintaining or improving habitat capability within important mule deer wintering areas.

Alternative C has the lowest projected potential program outputs and therefore would be expected to result in the lowest potential for additional impacts to existing sagebrush shrubland habitats. Alternative B would have somewhat higher projected program outputs than Alternative C and therefore would be expected to result in a somewhat higher potential for additional impacts to existing sagebrush shrubland habitats. Alternatives A and D are almost identical in potential projected program outputs and would have the highest projected outputs and therefore the greatest potential for additional potential impacts to existing sagebrush shrubland habitats and mule deer winter ranges. However, there would be little difference between Alternatives A and D in the relative degree of impact to sagebrush habitats and important mule deer winter range. Regardless of the alternative

selected, LRMP standards and guidelines and referenced documents and manuals such as those providing for the conservation of sagebrush habitats for Gunnison sage-grouse would ensure that sagebrush shrubland habitats remain available and well distributed across the planning area.

Impacts Related to Maintaining or Improving Habitat Conditions and Movement Opportunities within Wildlife Travel Corridors: A wildlife management challenge for the SJNF and TRFO is maintaining wildlife movement corridors, particularly for landscape connectivity for big game animals that must move between low-elevation wintering areas and generally higher-elevation summer areas. Maintaining movement opportunities across state and federal highways is very important and substantial numbers of deer and elk are killed each year attempting to cross highways. Roads constitute one of the greatest potential impacts to landscape connectivity and maintenance of biodiversity (Hebblewhite 2008). Deer and elk with migratory patterns connecting far removed summer and winter ranges have found busy highways in certain areas as obstacles to free movement with results that vary from high vehicle collision mortalities to totally impeding seasonal movements (Heffelfinger 2006). A management challenge for the SJNF and TRFO is to identify areas important for wildlife population connectivity and highway crossings, and to maintain or improve connectivity across human-made barriers to facilitate safe movement of animals along historical seasonal travel corridors.

A number of high use wildlife travel corridors have been identified on the SJNF and TRFO or in close proximity to lands managed by the SJNF and TRFO, primarily along the U.S. Highway 160 and 550 corridors (Johnson 2008; Southern Rockies Ecosystem Project 2006) and State Highway 141. Lands managed by the SJNF and TRFO that lie within and adjacent to the U.S. Highway 160 and 550 and State Highway 141 corridors in the identified areas have a variety of multiple use management activities occurring within them, including minerals development, fuels reduction projects (mechanical and prescribed fire), timber harvest projects, livestock grazing, and motorized recreation. All of these activities are proposed to continue, to varying extents, under the new LRMP.

Acres of federal minerals available for leasing are fairly similar across Alternatives A, B, and D. Alternatives A, B, and D open the largest amounts of federal minerals to leasing. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. Under the No Leasing Alternative, development would be limited to existing leases within the planning area. For timber harvest in the ponderosa pine and mixed conifer forests that predominate the SJNF and TRFO along these highway sections, Alternative C proposes the fewest acres of timber harvest, followed by Alternatives A and B, which project the same acres of timber harvest, then Alternative D, which projects the most timber harvest. Timber harvest activities may cause some temporary impacts to wildlife individuals in harvest activity areas, but restoration treatments are expected to be beneficial in the mid- to long term (5–10 years). For fuels treatments (mechanical and prescribed fire), there is little difference between the LRMP alternatives in projected activity outputs in ponderosa pine and mixed conifer forests. Some temporary impacts to individual animals may occur during project implementation, but long-term effects on wildlife habitat are expected to be primarily beneficial through the improvement of forage capacity. For motorized recreation, the acreage identified as suitable for motorized travel on NFS lands and limited for BLM lands would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. Because many of these highway sections are also designated by CPW as big game winter ranges, additional LRMP direction for maintaining habitat effectiveness designated winter ranges may also apply. For all alternatives and actions across the SJNF and TRFO, Alternative

C has the greatest potential to maintain wildlife movement corridors and landscape connectivity for big game animals, followed by Alternatives B, D, and A, respectively.

LRMP direction provides for maintaining or enhancing ecological conditions and habitat continuity near state and federal highways to provide for effective wildlife movement and connectivity within traditional use corridors. Because LRMP direction does not vary by alternative, projects would be required to consider impacts to wildlife corridors and wildlife habitat connectivity regardless of the selected LRMP alternative.

Cumulative Impacts Related to Influential Program Areas on General Species Groups

Actions taken to implement any of the alternatives, along with historic, current, and foreseeable future activities undertaken by the SJNF and TRFO or other entities, may result in combined or cumulative impacts on terrestrial wildlife and wildlife species. However, potential impacts from all of the alternatives would be constrained by LRMP components and would be supported by laws, regulations, and policies.

Currently, the human population within and near the planning area is projected to grow substantially over the projected life of the LRMP. This trend is expected to result in increased fragmentation and loss of wildlife habitats on private lands that surround and occur within the planning area. The trend in human population growth is also expected to result in increased demand for goods and services from USFS and BLM lands in the planning area. These increases would place additional pressures on public lands to supply the amount and variety of habitats, and the seclusion needed by the variety of wildlife species that inhabit the planning area. LRMP components have been developed through consideration of these trends and influences. In general, application of LRMP standards and guidelines and referenced guidance and BMPs, is expected to ensure that cumulative impacts to wildlife habitats from projects carried out under LRMP implementation, regardless of the alternative selected, would be minor to moderate in degree of impact and limited in scale in relation to requisite habitats that exist in the planning area. For this reason, cumulative effects from LRMP implementation are not expected to result in detectible changes to species abundance or distribution across the planning area.

Threatened and Endangered Terrestrial Wildlife Species

The four federally listed terrestrial wildlife species evaluated in the LRMP include Canada lynx, southwestern willow flycatcher, Mexican spotted owl, and Uncompahgre fritillary butterfly. Two additional species, North American wolverine and Gunnison sage-grouse, are proposed for listing under the ESA. Consultation for this planning process occurs with the USFWS through a BA (BLM 2013; USFS 2013). The USFS BA is contained in Volume III, Appendix J, and statements in this analysis are consistent with the BA. Formal consultation under Section 7 of the ESA for BLM lands is ongoing as of the publication of this FEIS, and the BLM BA will be published with the LRMP ROD. The ROD will include information to ensure that this FEIS analysis is consistent with the accepted BA by the USFWS. The FEIS and associated planning documents do not provide site or project-specific analysis of effects to individual listed species. Instead, they provide the guidance for planning and implementing projects to move the land base toward meeting and maintaining desired future conditions. Guidance is included for federally listed, proposed, and candidate species and their habitats. Much of the direction concerning these species is incorporated by reference from existing legislation, policy, agreements, recovery plans, and conservation plans. These documents, including species recovery plans are subject to change over time due to the incorporation of new scientific information. This would result in a better understanding of conservation measures to benefit the

species. The final approved LRMP is intended to be a dynamic document and would adopt the most recent versions of management direction agreed to with the USFWS for conservation of these species.

Terrestrial wildlife LRMP guidelines would be the same under all LRMP alternatives. These components would include mitigation, stipulation, and conservation measures. LRMP components for terrestrial wildlife are listed in Volume II, Section 2.3. For listed species, actions associated with implementing the selected alternative may impact a listed species and/or its habitat. LRMP components including mitigation, stipulation, and conservation measures for listed species are expected to conserve listed species regardless of the selected alternative. Separate site- and project-specific consultation with the USFWS would be undertaken during the NEPA process, as necessary, when projects are proposed for implementation under the LRMP.

Canada Lynx

Canada lynx was listed as a threatened species under the ESA in March 2000 for the DPS that occurs in the lower 48 contiguous United States. No recovery plan has been developed for the lynx, and a critical habitat designation in 2006 did not identify any critical habitat for lynx in the southern Rocky Mountains. Colorado was not included in the critical habitat designation because the conservation agreement between the USFS and USFWS, and agreement by the USFS to incorporate conservation measures from the LCAS (Ruediger et al. 2000). Canada lynx habitat on NFS lands in Colorado is managed in accordance with the SRLA (USFS 2008b), with modifications or additional direction that have been developed in consultation with the USFWS when/if such is developed. The SRLA contains management direction in the form of management objectives, standards, and guidelines that are intended to provide a consistent approach to conserve lynx and lynx habitat. Much of the management direction in the SRLA is based on management recommendations contained in the LCAS. Management of lynx habitat on BLM lands in Colorado is directed by conservation recommendations contained in the LCAS.

As detailed in the USFS BA (see Volume III, Appendix J), Canada lynx is native to Colorado but by the early 1970s was considered to be a rare resident, with most records concentrated in central Colorado. In 1999 the Colorado Division of Wildlife (now CPW) began an augmentation program, releasing a total of 218 lynx into the state through 2006. Lynx continue to inhabit suitable high-elevation conifer forests (spruce-fir and cool-moist mixed conifer) from central Colorado south through the San Juan Mountains, and natural reproduction has been documented in many years. Lynx forage in forested stands with a high density of young, healthy trees or shrubs tall enough to protrude above the snow. These areas provide habitat for snowshoe hare, the lynx's primary prey. Lynx also forage in early successional stands with a substantial understory of shrubs and young conifers that provides forage and cover for snowshoe hare. Willow-riparian areas also provide year-round habitat for hares and thus is an important component of lynx habitat. Lynx denning habitat consists of mid-aged or mature and older forests with complex physical structure on the ground such as downed logs and trees or rocks and boulders.

Extensive amounts of suitable lynx habitats are well distributed across the SJNF and TRFO administrative units (see USFS BA, Volume III, Appendix J). Lynx are regularly detected on USFS and BLM lands in the planning area. CPW radio tracking data have shown that the planning area provides high quality year-round lynx habitat where natural reproduction has occurred. In total, six mapped linkage areas occur on the SJNF and TRFO (Inter-Agency Southern Rockies Lynx Project Decision Screens [USFS 2010a]).

LRMP standards and guidelines adopt management direction from the 2008 SRLA, guidance from the LCAS, and/or additional direction agreed upon with the USFWS. Adopting these management recommendations is expected to conserve habitats used by lynx in the planning area. The USFS BA (see Volume III, Appendix J) determined that with implementation of the SRLA management recommendations, and direction in the LRMP for conservation of riparian habitats, LRMP implementation “may affect and is likely to adversely affect” Canada lynx and lynx habitat. The primary reason for an adverse effect determination is due to direct and indirect effects associated with vegetation management and previously consulted on with the SRLA (USFS 2008b). Regardless of the alternative selected, LRMP components, including management recommendations contained in other referenced guidance, would continue to meet or exceed management considerations and recovery objectives associated with the lynx. The application of SRLA standards and guidelines is expected to reduce adverse effects to lynx, thereby maintaining the long-term persistence of the species across the SJNF.

LRMP components would continue to meet or exceed management considerations and recovery objectives associated with the lynx for habitat on BLM lands. The application of LCAS standards and guidelines are expected to reduce adverse effects to lynx, thereby maintaining the long-term persistence of the species. For these reasons, implementation of the LRMP “may affect and is not likely to adversely affect” Canada lynx and lynx habitat. Direct and indirect effects associated with LRMP implementation include habitat loss from recreational activities (development of facilities such as campgrounds, day use areas, trailhead parking areas, etc.) and livestock grazing management. LRMP implementation activities could also result in disturbance impacts to lynx, which are expected to be limited in scale and duration. LRMP implementation also has potential to increase snow compaction, increasing the potential for competition with other predators for food resources, and predation from competitors.

Impacts Related to Influential Program Areas: For timber harvest in the spruce-fir and cool-moist mixed conifer forests that comprise most lynx habitat in the planning area, Alternative C proposes the fewest acres of projected timber harvest activities, followed by Alternative B with substantially larger timber harvest activities, Alternative A, then Alternative D, which projects the most timber harvest activity. Under the most active LRMP alternative (Alternative D), projected timber harvest activities on NFS lands are very low, about 1% of suitable lynx habitat on NFS lands, and thus the degree of impact of projected timber harvest activities on overall lynx habitat conditions across the SJNF over the life of the LRMP is expected to be minor. Some timber treatments on SJNF lands could improve lynx denning, dispersal, and foraging habitat, while other treatments could have negative short-term impacts that render the habitat unsuitable on a temporary basis. Guidance contained in the 2008 SRLA Record of Decision (USFS and Colorado Department of Natural Resources 2008), and Implementation Guide (USFS and USFWS 2009), would apply to timber harvest activities on NFS lands under all alternatives. This guidance is expected to maintain lynx habitat capability on NFS lands regardless of which LRMP alternative is selected.

Management of lynx habitat on BLM lands is guided by the LCAS (Ruediger et al. 2000). This document provides direction to promote and maintain habitat conditions suitable for lynx persistence and movement. On BLM lands, timber harvest activities are projected to be about 1% of spruce-fir and cool-moist mixed conifer forests on the TRFO over the life of the LRMP under both Alternative A and Alternative B. Under Alternative C, timber harvest activity is projected to be less than 1% of these forests on BLM lands over the life of the LRMP; under Alternative D, harvest activities are projected to be about 4% of these forests over the life of the LRMP. Given the low rate of projected timber harvest activities on BLM lands, the degree of impact of projected timber harvest activities on overall lynx habitat conditions on BLM lands is expected to be minor over the life of the LRMP.

Fire managed for resource benefit could affect lynx habitat conditions across the planning area. The fire regime for spruce-fir forests during HRV conditions was dominated by infrequent, high-severity, stand-replacement fires driven by regional-scale climate associated with prolonged drought and high winds (Romme et al. 1997). Fire frequency was longer than 200 years. During the long periods between fires, chronic fine-scale disturbances (including insects, disease, avalanche, and wind) killed individual trees or small groups of trees (Veblen et al. 1991a). The current fire frequency regime of spruce-fir forests on the SJNF and TRFO is within the HRV (Romme et al. 2009). Under Alternative A, fire managed for resource benefit, including the occurrence of an infrequent high-severity event, could affect up to about 3% of lynx habitat on NFS lands and up to about 7% of lynx habitat on BLM lands under Alternatives B, C, and D.

Because of the unpredictable nature, low return frequency, and often higher severity of fire regimes typical of subalpine forests under HRV, effects of fires managed for resource benefit to lynx habitat conditions on the SJNF and TRFO are difficult to predict with reliability. Fires for resource benefit are expected to vary more by regional-scale climate and drought conditions, and vary less by management actions related to LRMP implementation activities.

For motorized recreation, the acreage identified as suitable for motorized travel on NFS lands and limited for BLM land would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. For motorized travel over snow, Alternative A would maintain current management, while Alternative C would have the most emphasis on non-motorized recreation and therefore could be expected to have the least potential for increased or expanded extent of compacted snow areas in lynx habitats, especially in areas that are further removed from primary highway mountain passes. Alternative A would have the most emphasis on motorized recreation and could be expected to have the greatest potential for increased or expanded extent of compacted snow areas in lynx habitat, potentially reducing winter habitat capability for lynx in compacted snow areas. On both USFS and BLM lands, the alternative that would best maintain current winter habitat conditions for lynx, based on the amount of area not suitable for oversnow motorized travel, would be Alternative C, followed to a lesser extent by Alternative B, with Alternatives D and A being the least and very similar.

For recreation opportunities on the SJNF, MAs 1, 2, and 3 emphasize less intensive forms of recreation opportunities, less development of recreation infrastructure and facilities, and less intensive recreation emphasis, as compared to MAs 4, 5, 6, 7, and 8. Based on proposed land allocations within these two groups, Alternative C has substantially more area of the SJNF allocated to MAs 1, 2, and 3, followed by Alternatives B, D, and Alternative A, respectively. Given the focus of MAs 1, 2, and 3 on less intensive forms of recreation opportunities, it is reasonable to conclude that Alternative C has the least potential for recreation impacts to lynx habitat, followed by Alternatives B, D, and A, respectively. There is no difference among the alternatives in projected development of trails or other recreation opportunity infrastructure and thus no difference among the alternatives in projected potential for recreation infrastructure to impact lynx habitat on the SJNF. For recreation opportunities in designated wilderness, there is no difference among the alternatives in projected outputs for dispersed recreation, and therefore no difference between the alternatives in the potential for recreation activities to impact lynx habitat in wilderness on the SJNF.

The projected activity levels of permitted outfitter and guide operations, special use permits for access to interspersed private lands, and utility ROWs are not expected to vary by LRMP alternative. All of these activities are expected to continue under LRMP implementation. For all alternatives and

actions across the SJNF and TRFO, Alternative C is expected to have the greatest potential to maintain lynx habitat conditions, followed by Alternatives B, D, and A, respectively.

The potential for impacts from livestock grazing activities to lynx habitats would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. Under Alternative D, livestock management may need to be more intensive and may require more investments in range improvements (including fencing, vegetation manipulation, and water developments) to avoid or otherwise mitigate potential impacts to resources such as high-elevation riparian areas that provide an important component of year-round lynx habitat. Alternative C would provide the most opportunity to remedy livestock grazing conflicts with other resources because livestock grazing would occur on fewer acres and stocking rates would be lower than under any other alternative.

Mexican Spotted Owl

In 1993, the USFWS listed the Mexican spotted owl as threatened under the ESA. Critical habitat for the Mexican spotted owl was designated in 2004 on federal lands in Arizona, Colorado, New Mexico, and Utah. No critical habitat was designated on the SJNF or TRFO. Despite extensive surveys on the SJNF and TRFO, only three verified individuals and one probable detection of a single individual has occurred in the planning area, all in the southeast portion of the SJNF. All four detections were within steep canyons containing mature mixed conifer vegetation. These detections may represent dispersing or migratory individuals (see the USFS BA, Volume III, Appendix J). The occurrence of Mexican spotted owl in the planning area appears to be incidental and uncommon, and apparently suitable habitat remains unoccupied. No protected activity centers have been identified in the planning area. The USFS BA (see Volume III, Appendix J) reported that most of the existing Mexican spotted owl habitat on the SJNF is located in protected areas, which include the Chimney Rock National Monument, CRAs, designated wilderness, the Piedra Area, or RNAs. There are 91 miles of apparently suitable canyon habitat on the TRFO, primarily in remote canyons associated with the Dolores River drainage.

LRMP standards and guidelines adopt management recommendations from the 2012 Mexican Spotted Owl Recovery Plan (USFWS 2012c), with modifications or additional direction that has been developed in consultation with the USFWS when/if such is developed. Adopting these relevant findings would further management and conservation of habitats potentially used by Mexican spotted owl in the planning area. The USFS (see Volume III, Appendix J) determined that with implementation of the Mexican Spotted Owl Recovery Plan and direction in the LRMP, implementation “may affect, but is not likely to adversely affect” the Mexican spotted owl or its habitats. These determinations were based on LRMP components, including mitigation and conservation measures from additional referenced guidance including the Mexican Spotted Owl Recovery Plan (USFWS 2012c), and/or direction agreed to with the USFWS, and would continue to meet or exceed management considerations of the Mexican Spotted Owl Recovery Plan. In addition, the LRMP’s increased emphasis on restoration activities within ponderosa pine and warm-dry mixed conifer systems is expected to improve ecological function in these forests, thereby improving habitat conditions for the Mexican spotted owl over the long-term. The BLM BA and formal consultation under Section 7 of the ESA is ongoing as of the publication of this FEIS. However, given that the same mitigation measures and plan components will be applied on BLM lands, it is anticipated that the will have the same determination as the USFS BA for Mexican spotted owl. Any changes from the USFWS would be disclosed with the BLM ROD.

Impacts Related to Influential Program Areas: The USFS BA determined that few management activities have occurred in Mexican spotted owl habitats on the respective administrative units (the same determination is anticipated in the BLM BA). The primary potentially influential LRMP implementation program areas for Mexican spotted owl habitat are fuels treatments and livestock grazing activities on USFS and BLM lands, and minerals development on BLM lands. For fuels treatments (mechanical and prescribed fire), there is little difference between the LRMP alternatives in projected activity outputs in ponderosa pine and mixed conifer forests. Some temporary impacts to individual owls could occur during project implementation, but long-term effects on habitat conditions are expected to be primarily beneficial through moving forest conditions more closely to those that resemble HRV conditions. Within the LRMP, direction (desired conditions, objectives, standards, and guidelines) designed to maintain or enhance conditions most commonly found in old growth and old growth development stages would be the same across all alternatives. For this reason, LRMP implementation under all alternatives is expected to move conditions in ponderosa pine and warm-dry mixed-confer forests closer to those expected under HRV, thereby improving habitat capability for the Mexican spotted owl.

Grazing by domestic livestock is limited in the planning area because of an overall lack of preferred grass-forb forage in the typically closed canopy, steep sloped, mixed conifer habitats preferred by the Mexican spotted owl. The potential for impacts from livestock grazing activities to Mexican spotted owl habitats would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. Under Alternative D, livestock management may need to be more intensive and may require more investments in range improvements (including fencing, vegetation manipulation, and water developments) to avoid or otherwise mitigate potential impacts to resources such as riparian areas. Alternative C would provide the most opportunity to remedy livestock grazing impacts because livestock grazing would occur on fewer acres and stocking rates would be lower than under any other alternative.

For minerals development on BLM land, uranium mining is the most prevalent activity in Mexican spotted owl habitat, and activities are limited. There is one active uranium mine. Many mining claims overlap Mexican spotted owl habitat; however, most activity is on the mesa tops above the canyons. Little or no active uranium mining occurs within the canyon walls. The abandoned mine program is active in Mexican spotted owl habitat. It is expected that on average five abandoned mines would be closed in Mexican spotted owl habitat annually for the life of the LRMP. Oil and gas operations adjacent to Mexican spotted owl habitat would have the potential to disturb individuals if activities were to take place during the nesting season. Impacts from mineral development would occur to some extent under all LRMP alternatives. Acres of federal minerals available for leasing are fairly similar across Alternatives A, B, and D. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. Under the No Leasing Alternative, development would be limited to existing leases within the planning area. Because Alternative A projects the most acres of disturbance on leased and unleased lands it has the greatest potential for disturbance and other impacts to Mexican spotted owl and its habitats, followed by Alternatives D, B, and C, respectively.

<u>Southwestern Willow Flycatcher</u>

In March 1995, the southwestern willow flycatcher was listed as an endangered species under the ESA. A 2005 designation of critical habitat was recently revised (USFWS 2013e), but no critical habitat was identified on the SJNF or TRFO. The USFS BA (see Volume III, Appendix J) reported that

despite extensive surveys in apparently suitable habitat, only one site occupied by southwestern willow flycatcher has been detected in the planning area, on the eastern side of the SJNF at about 8,500 feet elevation. No southwestern willow flycatchers have been detected on the TRFO. There are no confirmed breeding populations on the SJNF or TRFO. The one site where the southwestern willow flycatcher has occurred on the SJNF has been occupied intermittently for at least 10 years by zero to four singing males, and as such the population is too small to detect a long-term trend. Much apparently suitable habitat occurs on the SJNF and TRFO, but remains unoccupied.

As reviewed in the USFS BA (see Volume III, Appendix J), the southwestern willow flycatcher breeds only in dense riparian vegetation near surface water or saturated soil. In Colorado, willow or other riparian habitat must be on average at least 5 feet high to be suitable for the southwestern willow flycatcher. Below 8,500 feet elevation, habitat patches as small as 0.25 acre (30 feet wide by 30 feet long by average 5 feet high) could support species occupancy (USFS 2012b; USFWS 2012d). Above 8,500 feet, however, a minimum patch size of 5 acres or greater is necessary to be considered suitable for southwestern willow flycatcher occupancy. Slow moving or standing surface water, or subsurface water, is nearly always found near breeding territories, but habitat occupancy cannot be ruled out if habitat of sufficient width exists near flowing streams (see the USFS BA, Volume III, Appendix J).

LRMP standards and guidelines adopt management recommendations from the 2002 Southwestern Willow Flycatcher Recovery Plan (USFWS 2002a), with modifications that have been developed in consultation with the USFWS to account for local conditions that differ from those described in the recovery plan (USFS 2012b; USFWS 2012d). Adopting these management recommendations with local modifications is expected to further management and conservation of habitats potentially used by the southwestern willow flycatcher in the planning area. The USFS BA (see Volume III, Appendix J) determined that with implementation of the Southwestern Willow Flycatcher Recovery Plan, site-specific modifications and/or direction agreed upon with the USFWS, and direction in the LRMP for conservation of riparian habitats, LRMP implementation “may affect, but is not likely to adversely affect” the southwestern willow flycatcher or habitats that could be used by the species.

Impacts Related to Influential Program Areas: Influential program areas that have the potential to affect habitat capability for the southwestern willow flycatcher include livestock grazing, recreation management, energy development, vegetation management, and travel management program areas, and is related to the potential of these program areas to affect willow-riparian systems that provide habitat for the southwestern willow flycatcher (USFS 2012b). The one known site on the SJNF intermittently occupied by the southwestern willow flycatcher is considered secure with a stable habitat trend (see the USFS BA, Volume III, Appendix J).

The potential for impacts from livestock grazing activities to southwestern willow flycatcher habitat, and riparian habitats in general, would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. Under Alternative D, livestock management may need to be more intensive and may require more investments in range improvements (including fencing, vegetation manipulation, and water developments) to avoid or otherwise mitigate potential impacts to resources such as riparian areas. Alternative C would provide the most opportunity to remedy livestock grazing conflicts with other resources because livestock grazing would occur on fewer acres and stocking rates would be lower than under any other alternative.

For recreation opportunities on the SJNF, MAs 1, 2, and 3 emphasize less intensive forms of recreation opportunities, less development of recreation infrastructure and facilities, and less

intensive recreation emphasis, as compared to MAs 4, 5, 6, 7, and 8. Based on proposed land allocations within these two groups, Alternative C has substantially more area of the SJNF allocated to MAs 1, 2, and 3, followed by Alternatives B, D, and A, respectively. Given the focus of MAs 1, 2, and 3 on less intensive forms of recreation opportunities, it is reasonable to conclude that Alternative C has the least potential for recreation impacts to southwestern willow flycatcher habitat, followed by Alternatives B, D, and A, respectively. There is no difference among the alternatives in projected development of trails or other recreation opportunity infrastructure and thus no difference among the alternatives in projected potential for recreation infrastructure to impact southwestern willow flycatcher habitat on the SJNF. For recreation opportunities in designated wilderness, there is no difference among the alternatives in projected outputs for dispersed recreation, and therefore no difference between the alternatives in the potential for recreation activities to impact southwestern willow flycatcher habitat in wilderness on the SJNF.

Impacts from fluid mineral energy development would occur to some extent under all alternatives. Acres of federal minerals available for leasing are fairly similar across alternatives A, B, and D. Alternative C opens substantially fewer amounts of federal minerals to leasing than Alternatives A, B, or D. Under the No Leasing Alternative, development would be limited to existing leases within the planning area. Because Alternative A projects the most acres of disturbance on leased and unleased lands it has the greatest potential for impacts to southwestern willow flycatcher habitats, followed by Alternatives D, B, and C, respectively. Alternatives A, B, and C offer the greatest protection to riparian areas because more stipulations that apply are NSO. Alternative D offers the least protection to riparian areas because more stipulations that apply are CSU.

Direct impacts to southwestern willow flycatcher habitats from vegetation management projects are unlikely due to a variety of LRMP components that protect and maintain the ecological function of riparian areas and water-dependent features. Indirect impacts from timber harvest and mechanical fuels treatment activities to habitat capability for southwestern willow flycatcher could occur under all LRMP alternatives. Impacts would most likely occur in surrounding upland areas, with indirect effects to water quantity and quality that supports the willow-riparian systems on which southwestern willow flycatcher habitat depends. Alternative C projects the fewest acres of timber harvest activities, followed by Alternatives A and B, which project nearly the same acres of timber harvest, then Alternative D, which projects the most timber harvest activities. For mechanical fuels treatments, Alternative D projects the most activities, with the same level of activity projected under Alternatives A, B, and C. There are no differences between the LRMP alternatives in projected activity outputs for prescribed fire activities.

For motorized travel, Alternative A would have the greatest potential for impacts to southwestern willow flycatcher habitat because it is the only alternative that would allow cross-country motorized travel off of designated routes. Alternatives B, C, and D would restrict motorized travel to designated routes thereby reducing potential for impacts to southwestern willow flycatcher habitats. The acreage identified as suitable for motorized travel on NFS lands and limited for BLM lands would be greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. Assuming that LRMP alternatives providing the greatest opportunities for motorized routes could also have the greatest potential for motorized travel impacts to riparian areas, then the greatest potential for impacts to southwestern willow flycatcher habitat could occur under Alternative A, followed by Alternatives D, B, and C, respectively.

Uncompahgre Fritillary Butterfly

The Uncompahgre fritillary butterfly is listed as an endangered species under the ESA. One occupied colony is known to exist in the planning area, and primary habitat is found across a portion of the planning area. There are few management actions associated with LRMP alternatives that could be expected to result in impacts to Uncompahgre fritillary butterfly or its primary habitat. This is because the species is restricted to higher-elevation alpine habitats that are often inaccessible, and much of the primary habitat in the planning area is within designated wilderness or WSAs. In some locations, however, it is possible that recreational activities and/or livestock grazing may influence the species and/or its habitat. Butterfly collecting is still considered to be the primary threat to Uncompahgre fritillary butterfly existence (USFWS 1994a), and access to colony areas may increase the risk of illegal collection by butterfly enthusiasts. Management activities that occur in occupied Uncompahgre fritillary butterfly habitat may decrease the amount of larval and adult host/forage plants, and possibly result in the loss of some larval or adult individuals.

LRMP standards and guidelines adopt the Uncompahgre Fritillary Butterfly Recovery Plan (USFWS 1994), with modifications or additional direction that has been developed in consultation with the USFWS when/if such is developed, and the USFWS, BLM, and USFS interagency agreement to conserve the species. In addition, the LRMP would continue to participate in and adopt the relevant findings from the annual field report, as well as from the interagency recovery team. Adopting these relevant findings would further management and conservation of the species. The USFS BA determined that with implementation of the Uncompahgre Fritillary Butterfly Recovery Plan and direction in the LRMP, implementation “may affect, but is not likely to adversely affect” the Uncompahgre fritillary butterfly or its habitat. These determinations were based on LRMP components, including mitigation, and conservation measures from additional referenced guidance and/or guidance agreed to with the USFWS, and would continue to meet or exceed management considerations and recovery objectives associated with the Uncompahgre Fritillary Butterfly Recovery Plan (USFWS 1994). The BLM BA and formal consultation under Section 7 of the ESA is ongoing as of the publication of this FEIS. However, given that the same mitigation measures and plan components will be applied on BLM lands, it is anticipated that the USFWS will have the same determination as the USFS BA for Uncompahgre fritillary butterfly.

Impacts Related to Influential Program Areas: Influential program areas that have the potential to affect habitat capability for Uncompahgre fritillary butterfly are limited to the livestock grazing (domestic sheep) and recreation program areas. The one known occupied Uncompahgre fritillary butterfly colony is located on the SJNF and is considered secure and stable (see the USFS BA, Volume III, Appendix J). The USFS BA states that no habitat threats have been identified for this colony due to its remoteness, and long-term monitoring has determined that the habitat patches supporting this colony are stable. The existing data indicate this population is persistent and it remains one of the most extensive of the known populations. Colony monitoring has found no direct or indirect effects to the colony from livestock grazing or recreation activities, but low levels of dispersed recreation have been documented within the colony.

For livestock grazing, Alternative B could maintain the same permitted numbers and acres of area for domestic sheep grazing as Alternative A; therefore, there would be little difference between Alternatives A and B in potential for sheep grazing to affect primary habitats for Uncompahgre fritillary butterfly. Under Alternative C, livestock grazing could be managed to enhance wildlife, cultural, and soils values, which could result in lower livestock stocking rates. Under Alternative C, domestic sheep numbers and allotment area acres could be reduced, compared to Alternatives A, B, and D. For this reason, Alternative C could reduce the potential for sheep grazing to affect primary habitats for

Uncompahgre fritillary butterfly, as compared to Alternatives A, B, or D. Under Alternative D, livestock grazing could be managed to increase grazing opportunities and therefore could increase domestic sheep numbers and allotment area acres. For this reason, Alternative D could result in greater potential for sheep grazing to affect primary habitats for Uncompahgre fritillary butterfly, as compared to Alternatives A, B, or C.

For recreation opportunities in designated wilderness, there is no difference among the alternatives in projected outputs for dispersed recreation, and therefore no difference between the alternatives in the potential for recreation activities to impact the one known occupied Uncompahgre fritillary butterfly site on the SJNF. There is no difference among the alternatives in projected development of trails or other recreation opportunity infrastructure and thus no difference among the alternatives in projected potential for recreation infrastructure to impact Uncompahgre fritillary butterfly primary habitat on the SJNF.

In general on the SJNF, MAs 1, 2, and 3 emphasize less intensive forms of recreation opportunities, less development of recreation infrastructure and facilities, and less intensive recreation emphasis, as compared to MAs 4, 5, 6, 7, and 8. Based on proposed land allocations within these two groups, Alternative C has substantially more area of the SJNF allocated to MAs 1, 2, and 3, followed by Alternatives B, D, and A, respectively. Given the focus of MAs 1, 2, and 3 on less intensive forms of recreation opportunities, it is reasonable to conclude that Alternative C has the least potential for recreation impacts to Uncompahgre fritillary butterfly primary habitat, followed by Alternatives B, D, and A, respectively.

Gunnison Sage-grouse

On January 11, 2013, the USFWS published a proposed rule to list the Gunnison sage-grouse as an endangered species under the ESA (USFWS 2013c). This proposed rule also proposed to designate critical habitat within the range of the species, including some areas on the SJNF and TRFO. Gunnison sage-grouse currently occurs in seven widely scattered and isolated populations in Colorado and Utah, including the Monticello–Dove Creek population, which occurs in part on the TRFO. There are approximately 109,908 acres of proposed occupied critical habitat within the planning area. There are approximately 48 acres of proposed critical habitat on the SJNF in Dolores County, but the USFS BA (see Appendix J) determined that no sage-grouse are present on the proposed critical habitat location or on any other lands managed by the SJNF.

Comprehensive management direction for Gunnison sage-grouse, in the form of standards, guidelines, and other referenced guidance, has been incorporated into the LRMP. In addition, a variety of standards and guidelines were developed to maintain or improve habitat conditions in sagebrush shrublands. Management direction is intended to maintain and improve ecological function of sagebrush shrublands, thereby maintaining or improving habitat capability for sage-grouse.

Although a wide variety of conservation measures would be applied during LRMP implementation that would reduce negative impacts to sage-grouse and their habitats and that substantial protections for sage-grouse are provided in the LRMP, implementation “may affect, is likely to adversely affect” Gunnison sage-grouse and proposed critical habitat. An adverse effect call is appropriate because LRMP components do not completely eliminate the potential for adverse impacts during LRMP implementation, such as those from the development of valid existing lease rights. In addition, LRMP components do not remove the potential for management discretion to approve exceptions to LRMP stipulations and guidelines. Although adverse impacts to sage-grouse are thought to be rare, the impact is not discountable and thus an adverse impact determination is appropriate.

The USFS BA (see Volume III, Appendix J) determined that the Preferred Alternative of the LRMP is "not likely to jeopardize the continued existence of Gunnison sage-grouse, or adversely modify proposed critical habitat." Because none of the LRMP alternatives are likely to jeopardize the continued existence of Gunnison sage-grouse, or destroy or adversely modify proposed critical habitat, conferencing with the USFWS on the effects of plan implementation to sage-grouse is not required.

For both the SJNF and TRFO, LRMP management direction for sage-grouse would minimize adverse impacts from land management actions. Following listing of the species or critical habitat, separate site- and project-specific consultation with the USFWS would be undertaken as necessary during the NEPA analysis process for projects proposed under LRMP implementation, if projects had the potential to affect sage-grouse or designated critical habitat for the species.

Impacts Related to Influential Program Areas: Actions that may impact Gunnison sage-grouse populations and habitat include mineral and energy development, geophysical exploration, recreation, fire and fuels management, livestock grazing, and utility corridors.

Impacts related to oil and gas development is discussed in Section 3.3.4, Fluid Minerals Leasing, below. Geophysical exploration may occur throughout Gunnison sage-grouse occupied habitat. Geophysical exploration may occur in accordance with standards and guidelines and outside critical life stages, such as lekking, nesting, brood rearing, and wintering. Minerals development in the form of potash exploration, uranium mining, and saleable minerals development are expected to occur within occupied Gunnison sage-grouse habitat. Potash exploration has the potential to further fragment Gunnison sage-grouse habitat in the Dove Creek populations. Suspected potash formations are thought to extend into Gunnison sage-grouse occupied habitat in Dove Creek, but the extent of any overlap between potash formations and occupied Gunnison sage-grouse habitat is not known. Depending on results from potash exploration, development may or may not occur in Gunnison sage-grouse occupied habitat. There is one active stone quarry in the Dry Creek Basin in occupied Gunnison sage-grouse habitat. There are no uranium leases in occupied Gunnison sage-grouse habitat; however, access to uranium mines and leases may occur through the Dry Creek area, which is occupied Gunnison sage-grouse habitat. New roads are not expected to be proposed for access to uranium leases; however, disruption from increased traffic is likely. Noise from traffic has been identified as a potential cause for declines in lek attendance (Blickley et al. 2012; Holloran 2005). Traffic during the daily strutting period had a greater influence on lek attendance compared to roads with no activity during the strutting period (Holloran 2005). LRMP standards to manage noise would limit the impact of noise from new disturbances.

Impacts related to recreation are expected to be limited. Recreation impacts are primarily in the form of big game hunting and mountain biking. Big game hunting occurs in the fall, not during a critical life stages such as nesting or brood rearing. Individual grouse may be temporarily displaced if flushed by hunters. Mountain biking and guided mountain bike tours occur within the Dry Creek area. Mountain biking in occupied habitat occurs on existing roads.

Impacts from mechanical fuels treatments could occur within occupied Gunnison sage-grouse habitat. Mechanical fuels treatments in occupied Gunnison sage-grouse habitat would be designed to increase habitat quality for the species by restoring juniper-encroached sagebrush habitats and other projects directed at restoring understory grasses and forbs. Approximately 2,500 acres are planned to be treated to improve sage-grouse habitat throughout the life of the LRMP. Timing restrictions in the form of plan standards and guidelines would mitigate impacts from mechanical treatments in occupied Gunnison sage-grouse habitat. Treatments in sage-grouse habitat would not occur during breeding, nesting, early brood rearing, or wintering for Gunnison sage-grouse. Some grouse may be

temporarily displaced by some treatments. No long-term negative impacts are anticipated from fuels or habitat treatments because all treatments in sage-grouse habitat would be required to restore or improve Gunnison sage-grouse habitat.

Alternative C has the lowest projected potential program outputs and therefore would be expected to result in the lowest potential for impacts to sagebrush shrubland habitats and to sage-grouse and its habitat. Alternative B would have somewhat higher projected program outputs than Alternative C and therefore would be expected to result in a somewhat higher potential for additional impacts to existing sagebrush shrublands and sage-grouse habitats. Alternatives A and D are almost identical in potential projected program outputs and would have the highest projected outputs and therefore the greatest potential for additional potential impacts to sage-grouse and its habitat. However, there would be little difference between Alternatives A and D in the relative degree of impact to sage-grouse habitats. Regardless of the alternative selected, LRMP standards and guidelines and referenced documents and manuals would ensure that sage-grouse habitats and sagebrush shrubland habitats remain available and well distributed across the planning area.

North American Wolverine

On February 4, 2013, the USFWS published a proposed rule to list the DPS of the North American wolverine occurring in the 48 contiguous United States as a threatened species under the ESA (USFWS 2013b). The proposed rule did not propose any critical habitat for the species. The primary reason for the proposed listing was predicted future loss of deep-snow habitats essential for wolverine reproduction and survival, due to global climate change melting late spring snowpack. The predicted loss of essential deep-snow habitats indicates that wolverines in the lower 48 states are threatened with extinction in the future due to loss of habitat in alpine deep-snow environments (USFWS 2013b). At this time, land management actions such as motorized and non-motorized recreation (winter and summer), timber management activities and infrastructure development are not considered to be threats to the existence of the wolverine and therefore would not be regulated under the proposed listing. There are numerous historical records of wolverines from the Colorado Rocky Mountains. However, at present, the species was believed to have been extirpated from the Southern Rocky Mountains including Colorado, New Mexico, and Wyoming by the early 1900s.

In a separate proposed rule, the USFWS proposed to establish a nonessential experimental population area for the wolverine in the southern Rocky Mountains of Colorado, northern New Mexico, and southern Wyoming (USFWS 2013f) under Section 10(j) of the ESA. This rule would allow legal incidental take of wolverine in the nonessential experimental population area and provide the regulatory assurances necessary to facilitate a state-led reintroduction of wolverine in Colorado, should the CPW decide to undertake a reintroduction effort.

No recovery plan or comprehensive management plan documents have been developed yet for the wolverine that would guide land management practices in wolverine habitat. Critical habitat for the wolverine has not yet been determined (USFWS 2013b). However, because most Canada lynx habitat on the SJNF and TRFO also provides habitat for wolverine, substantial management guidance exists for that portion of wolverine habitat that is also mapped as lynx habitat. Much of the remaining potential wolverine habitat on the SJNF and TRFO is in alpine areas and within designated wilderness or WSAs where natural processes predominate and management actions undertaken during LRMP implementation are likely to be small in scale and short in duration.

None of the LRMP alternatives are likely to jeopardize the continued existence of the wolverine because there is currently no wolverine population on the SJNF, the TRFO, or in the state of Colorado. In addition, the listing proposal stated that land management actions including recreation,

infrastructure development, and transportation corridors do not pose a threat to the wolverine DPS (USFWS 2013b). The USFS and BLM determined that because there is no wolverine population in the planning area, and because land management actions conducted under LRMP implementation are not thought to jeopardize the continued existence of the wolverine, conferencing with the USFWS on the effects of plan implementation to wolverine is not required. Following listing of the species, separate site- and project-specific consultation with the USFWS would be undertaken as necessary for LRMP implementation during NEPA analysis processes if projects were proposed that had the potential to affect wolverine or wolverine habitat.

Cumulative Impacts Related to Threatened and Endangered Terrestrial Wildlife Species

Actions taken to implement any of the alternatives, along with past, present, and reasonably foreseeable future activities undertaken by the SJNF, the TRFO, or on other ownerships may result in combined or cumulative impacts to species listed as threatened or endangered under the ESA. However, all alternatives would be limited by LRMP components designed, in part, to account for potential cumulative impacts of activities occurring on adjacent ownerships or from the combined effects of all program activities in the planning area. After considering direct, indirect, and cumulative effects to listed species, LRMP components are expected to provide the ecological conditions necessary to maintain or improve existing populations of listed species within their current distribution across the planning area. LRMP components that address listed species are founded in law, federal regulation, and policy that allows for periodic reviews and adjustments of the components as needed and as new information becomes available.

Currently, human populations near the planning area are projected to continue growing for the foreseeable future. This trend, and the associated increased demand for a wide variety of forest products and recreational opportunities across the planning area, may be one of the largest wildlife management challenges facing LRMP implementation. For Canada lynx, cumulative impacts associated with other land ownerships may include increased habitat fragmentation (due to highway infrastructure improvements and increased traffic volume, use and development of private in-holdings, mining activities on claim in-holdings, access across USFS or BLM lands to private in-holdings, etc.). Increased development of adjacent private lands around ski areas and expanded recreational pursuits by adjacent homeowners at private base area developments may also reduce habitat capability for lynx as animals move across the landscape irrespective of land ownership boundaries. However, the majority of spruce-fir forest in the area occurs on USFS and BLM lands, with relatively large and unroaded expanses occurring within backcountry, designated wilderness, and WSAs that are expected to provide large blocks of high-quality habitats for lynx within the planning area.

For Mexican spotted owl, suitable habitat is well distributed across the planning area. Much of the habitats used by the species on other adjacent land ownerships has been heavily modified due to past management impacts. Potential cumulative impacts to Mexican spotted owl are expected to be reduced by the LRMP's increased emphasis on restoration activities within ponderosa pine and warm-dry mixed conifer systems. Restoration activities are expected to improve ecological function in these forests, thereby improving habitat conditions for Mexican spotted owl over the long-term.

For Uncompahgre fritillary butterfly, few direct and indirect effects are likely from LRMP implementation, and therefore few cumulative effects are likely. Given the remote and relatively protected nature of most Uncompahgre fritillary butterfly suitable habitat and the only known occupied colony (in designated wilderness on the SJNF), there is little potential for cumulative effects because there are few non-federal lands or activities occurring in proximity to Uncompahgre fritillary butterfly habitats. Activities that are outside the jurisdiction of the BLM and USFS include residential and

agricultural development. For Gunnison sage-grouse, these activities on private lands increase habitat fragmentation and potential for grouse predation, reducing grouse habitat capability across the matrix of land ownerships that comprise available sage-grouse habitats.

No LRMP alternative is expected to result in cumulative impacts to any listed species that occurs in the planning area that could be of sufficient extent or magnitude to result in changes to a species distribution or relative abundance in the planning area. LRMP monitoring requirements and adaptive management principles are expected to help identify changes to habitats for listed species and guide decisions about the potential need for management changes to address unanticipated cumulative impacts over the life of the LRMP.

<u>Wildlife Issues Related to Threatened and Endangered Terrestrial Wildlife Species</u>

Impacts Related to Maintaining or Improving Landscape Connectivity for Canada Lynx: A wildlife management challenge on the SJNF and TRFO is maintaining wildlife movement corridors, particularly for landscape connectivity for wide-ranging forest carnivores such as Canada lynx. It has been suggested that for Canada lynx, large-scale connectivity may be more important for long-term population persistence than local habitat conditions (McKelvey et al. 1999). Maintaining movement opportunities across state and federal highways that cross lands managed by the SJNF and TRFO is very important to maintaining large-scale connectivity, and several lynx mortalities have been documented on federal highways that cross the SJNF and TRFO. Roads constitute one of the greatest potential impacts to landscape connectivity and maintenance of biodiversity (Hebblewhite 2008). A management challenge on the SJNF and TRFO is to identify areas important for wildlife connectivity and for safe crossing of high speed and/or high volume roads.

Within the LRMP, direction (desired conditions, objectives, standards, and guidelines) provides for maintaining or enhancing ecological conditions and habitat continuity near state and federal highways to provide for effective wildlife movement and connectivity within traditional use corridors. Because LRMP direction does not vary by alternative, projects would be required to consider impacts to wildlife corridors and wildlife habitat connectivity regardless of the selected LRMP alternative.

Six landscape linkages have been identified for Canada lynx on the SJNF and TRFO (Inter-Agency Lynx Project Decision Screens 2010), of which five are on SJNF lands and one is on TRFO lands. These linkage areas are thought to be important areas for lynx movement and landscape connectivity. Of these six linkage areas, five are along highways that are in close proximity to lands managed by the SJNF and TRFO. Highway corridors where linkage areas have been identified include the State Highway 145, the U.S. Highway 160 and 550 corridors, and San Juan County Road 110. Lands managed by the SJNF and TRFO that lie within and adjacent to these corridors in mapped linkage areas have a variety of multiple use activities occurring within them, including timber harvest projects, recreation activities (motorized and non-motorized), livestock grazing, permitted outfitter and guide operations, special use permits for access to interspersed private lands, and utility ROWs. All of these activities are proposed to continue, to varying extents, under all alternatives in the new LRMP.

For timber harvest in the spruce-fir and cool-moist mixed conifer forests that predominate the SJNF and TRFO within linkage areas along these highway sections, Alternative C proposes the fewest acres of projected timber harvest activities, followed by Alternatives B with substantially larger timber harvest activities, Alternative A, then Alternative D, which projects the most timber harvest activity. Under the most active LRMP alternative (Alternative D), projected timber harvest activities on NFS lands are very low, about 1% of suitable lynx habitat on NFS lands and thus the degree of impact of projected timber harvest activities on overall lynx habitat conditions across the SJNF over the life of

the LRMP is expected to be minor. Some treatments could improve lynx denning, dispersal, and foraging habitat, while other treatments could have negative short-term impacts that render the habitat unsuitable on a temporary basis. Guidance contained in the 2008 SRLA Record of Decision (USFS and Colorado Department of Natural Resources 2008), and Implementation Guide (USFS and USFWS 2009) would apply to timber harvest activities in linkage areas on NFS lands under all alternatives. This guidance is expected to maintain linkage area function and connectivity on NFS lands regardless of which LRMP alternative is selected.

Management of lynx habitat on BLM lands is guided by the LCAS (Ruediger et al. 2000). This document provides direction to manage habitats within mapped linkage areas to promote and maintain habitat connectivity and animal movement. On BLM lands, timber harvest activities are projected to be about 1% of spruce-fir and cool-moist mixed conifer forests on the TRFO over the life of the LRMP under both Alternatives A and B. Under Alternative C, timber harvest activity is projected to be less than 1% of these forests on BLM lands over the life of the LRMP, and under Alternative D, harvest activities are projected to be about 4% of these forests over the life of the LRMP. Given the low rate of projected timber harvest activities on BLM lands, the degree of impact of projected timber harvest activities on overall lynx habitat conditions on BLM lands is expected to be minor over the life of the LRMP. Regardless of which LRMP alternative is selected, guidance in the LCAS (Ruediger et al. 2000) is expected to maintain linkage area function and connectivity on BLM lands.

Fire managed for resource benefit could affect lynx habitat conditions in linkage areas and lynx habitat conditions across the SJNF and TRFO. The fire regime for spruce-fir forests during HRV conditions was dominated by infrequent, high-severity, stand-replacement fires driven by regional-scale climate associated with prolonged drought and high winds (Romme et al. 1997). Fire frequency was longer than 200 years. During the long periods between fires, chronic fine-scale disturbances (including insects, disease, avalanche, and wind) killed individual trees or small groups of trees (Veblen et al. 1991a). The current fire frequency regime of spruce-fir forests on the SJNF and TRFO is within the HRV (Romme et al. 2009). Under Alternative A, fire managed for resource benefit, including the occurrence of an infrequent high-severity event, could affect up to about 3% of lynx habitat on NFS lands and up to about 7% of lynx habitat on BLM lands under Alternatives B, C, and D.

Because of the unpredictable nature, low return frequency, and often higher severity of fire regimes typical of subalpine forests under HRV, effects of fires managed for resource benefit to lynx habitat conditions on the SJNF and TRFO are difficult to predict with reliability. Fires for resource benefit are expected to vary more by regional-scale climate and drought conditions and vary less by management actions related to LRMP implementation activities.

For motorized recreation, the acreage identified as suitable for motorized travel on NFS lands and limited for BLM lands would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. The projected activity levels of permitted outfitter and guide operations, special use permits for access to interspersed private lands, and utility ROWs are not expected to vary by LRMP alternative. All are expected to continue under LRMP implementation. For all alternatives and actions across the SJNF and TRFO, Alternative C is expected to have the greatest potential to maintain Canada lynx movement and connectivity across large landscapes, followed by Alternatives B, D, and A, respectively.

BLM and USFS Terrestrial Wildlife Sensitive Species

BLM and USFS terrestrial wildlife sensitive species for the planning area and the habitats with which each species is associated are listed in Table 3.3.3 (above). These include 12 mammal, 20 bird, two reptile, three amphibian, and one insect species from the BLM Colorado and USFS Region 2 lists. These species have habitat within the planning area on designated agency lands. See Appendix T, SJNF Biological Evaluation and BLM Sensitive Species Analysis, for a detailed analysis of each species, including a comparison of the potential effects of each alternative.

The LRMP/FEIS and associated planning documents do not provide site- or project-specific analysis. Instead, they provide the guidance for planning and implementing projects designed to move the land base toward meeting and maintaining desired future conditions. Guidance is included for the BLM and USFS sensitive species and the habitats on which they depend. Much of the direction concerning these species is incorporated by reference from existing legislation, policy, agreements, and conservation plans, including the Colorado Comprehensive Wildlife Plan (Colorado Division of Wildlife 2006). Direction contained in these documents is subject to change over time, as new scientific information is developed which results in a better understanding of management and conservation techniques for a species, or from changes in authorities under legislation or policy. The LRMP (Volume II) lists the plan components, conservation measures, and other existing direction that apply to terrestrial wildlife species within the planning area. This direction is the same under all alternatives. The final approved LRMP is intended to be a dynamic document and would adopt the most recent version or management framework agreed upon by the agencies

Table 3.3.5 summarizes findings from the SJNF Biological Evaluation (see Appendix T) for each sensitive species for all alternatives. USFS policy requires a Biological Evaluation be prepared that discloses anticipated effects to each designated sensitive species and requires a specific determination of effect for each sensitive species. BLM policy requires preparing an analysis of potential effects to each agency-designated sensitive species, but not a Biological Evaluation. Appendix T also contains the BLM Sensitive Species Analysis document. Separate site- and project-specific NEPA analysis would occur as projects are proposed for implementation, and determinations and/or analysis of potential impacts could be different from those displayed below in Table 3.3.5 or in the BLM Sensitive Species Analysis documents. Determinations identified in Table 3.3.5 apply to USFS only.

Table 3.3.5: Summary of Findings for USFS Sensitive Wildlife Species

Species	Agency Designated	USFS Determination
Birds		
American bittern Botaurus lentiginosus	USFS	MAII
American peregrine falcon Falco peregrinus anatum	BLM and USFS	MAII
American bald eagle Haliaeetus leucocephalus	BLM and USFS	MAII
Black swift Cypseloides niger	BLM and USFS	MAII
Boreal owl Aegolius funereus	USFS	MAII
Brewer’s sparrow Spizella breweri	BLM and USFS	MAII
Columbian sharp-tailed grouse Pediocetes phasianellus columbianus	BLM	

Species	Agency Designated	USFS Determination
Ferruginous hawk Buteo regalis	BLM and USFS	MAII
Flammulated owl Otus flammeolus	USFS	MAII
Lewis' woodpecker Melanerpes lewis	USFS	MAII
Loggerhead shrike Lanius ludovicianus	USFS	MAII
Northern goshawk Accipiter gentilis	BLM and USFS	MAII
Northern harrier Circus cyaneus	USFS	MAII
Olive-sided flycatcher Contopus cooperi	USFS	MAII
Purple martin Progne subis	USFS	MAII
Short-eared owl Asio flammeus	USFS	MAII
Western burrowing owl Athene cunicularia	BLM and USFS	MAII
Western yellow-billed cuckoo Coccyzus americanus	BLM and USFS	MAII
White-faced Ibis Plegadis chihi	BLM	
White-tailed ptarmigan Lagopus leucurus	USFS	MAII
Insects		
Great Basin silverspot butterfly (Nokomis fritillary butterfly) Speyeria nokomis nokomis	BLM and USFS	MAII
Mammals		
Allen's big-eared bat Idionycteris phyllotis	BLM	
American marten Martes americana	USFS	MAII
Big free-tailed bat Nyctinomops macrotis	BLM	
Desert bighorn sheep Ovis canadensis nelson or mexicana	BLM	
Fringed myotis Myotis thysanodes pahasapensis	BLM and USFS	MAII
Gunnison's prairie dog Cynomys gunnisoni	BLM and USFS	MAII
Hoary bat Lasiurus cinereus	USFS	MAII
New Mexico meadow jumping mouse Zapus hudsonius luteus	BLM and USFS	MAII
North American river otter Lontra canadensis	USFS	MAII
Rocky Mountain bighorn sheep Ovis canadensis canadensis	USFS	MAII
Spotted bat Euderma maculatum	BLM and USFS	MAII

Species	Agency Designated	USFS Determination
Townsend's big-eared bat Corynorhinus townsendii	BLM and USFS	MAII
Reptiles		
Desert spiny lizard Sceloporus magister	BLM	
Longnose leopard lizard Gambelia wislizenii	BLM	
Amphibians		
Boreal toad Bufo boreas	BLM and USFS	MAII
Canyon tree frog Hyla arenicolor	BLM	
Northern leopard frog Rana pipiens	BLM and USFS	MAII
NI = No impact MAII = May adversely impact individuals, but not likely to result in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range wide.		

See Volume III, Appendix T, SJNF Biological Evaluation and BLM Sensitive Species Analysis, for a detailed analysis of the effects of LRMP implementation on respective agency-designated sensitive species and the potential impacts of LRMP implementation under each alternative. In general, within the planning area the wide variety of sensitive species and their preferred habitats suggests that all LRMP alternatives have potential for some effect on some sensitive species or their preferred habitats. Effects could be both negative and beneficial, depending on the species and habitats affected. As with other species groups, LRMP alternatives that emphasize more ground-disturbing activity in or near primary habitat areas for sensitive species (such as nesting sites, roosting sites, production areas, and wintering areas) would have a greater potential for impact to some sensitive species or increase the intensity of impacts to some sensitive species. The potential for influential impacts and disturbances would vary widely among sensitive species and varies between the alternatives. LRMP implementation activities that occur in close proximity to active breeding and young-rearing areas and other important habitats such as roosting or wintering areas, would be more likely to have impacts of greater intensity, and on a wider variety of sensitive species. Application of LRMP standards and guidelines and management recommendations from referenced documents and manuals during project design and implementation should ensure that the scale of impact is minimized and the intensity of effects is reduced to the extent possible. In general, the distribution of habitat components and habitat diversity across the planning area would be guided by land capability and HRV. The habitats affected by LRMP implementation would vary somewhat in distribution, depending on the alternative selected. LRMP components relating to management of landscape connectivity areas, forest structural stage and canopy cover objectives, retention of snags and downed woody debris, and maintenance of wetlands and water-dependent features would maintain habitat capability for some sensitive species.

The potential for impact, as well as the potential need for adjustment and monitoring of project effects, to some sensitive species and their key habitat components is likely to be greatest under Alternative D. The potential for impacts to sensitive species is likely to be least under Alternative C, and is likely to be similar between Alternatives A and B. The differences between alternatives would be due to the greater projected outputs under Alternative D and acres available for timber harvest, the available livestock AUMs, fluid minerals development scenarios, and greater acres suitable for summer motorized travel. Alternative D would also have a larger amount of land area available for active management activities that may, in turn, impact habitats for sensitive species, movements of

individuals, and the potential for human disturbance to sensitive species or their key habitats or use areas. Alternatives B, C, and D would eliminate cross-country motorized use. Eliminating cross-country motorized travel and limiting motorized travel to a system of designated routes would substantially reduce the potential for disturbance to sensitive species, compared to the potential for disturbance in areas of unrestricted cross-country travel that would remain available under Alternative A.

The potential for impacts from livestock grazing activities to sensitive species associated with riparian areas, wetlands, and spring and seep habitats would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. For timber harvest in lower-elevation forests such as ponderosa pine and warm-dry mixed conifer where some sensitive species are most abundant on the SJNF, Alternative C proposes the fewest acres of timber harvest, followed by Alternatives A and B, which project the same acres of timber harvest, then Alternative D, which projects the most timber harvest. Timber harvest activities may cause some temporary impacts to individuals in harvest activity areas, but restoration treatments are expected to be beneficial in the mid- to long term (5–10 years or more). For fuels treatments (mechanical and prescribed fire), there is little difference between the LRMP alternatives in projected activity outputs in ponderosa pine and mixed conifer forests. Some temporary impacts to individuals may occur during project implementation, but long-term effects (10 years or more) on habitats for sensitive species are expected to be primarily beneficial through movement of ecological conditions closer to those expected under HRV. LRMP standards and guidelines and management direction from referenced documents and manuals should ensure that habitats are available sufficient to support CPW management goals for sensitive species that are also game species.

<u>Wildlife Issues Related to BLM and USFS Sensitive Species</u>

Impacts Related to Bighorn/Domestic Sheep Contact: Due to their high economic and aesthetic values, bighorn sheep are important to the planning area, the State of Colorado, and the public. As described above, a primary issue related to the management of bighorn sheep on the SJNF and TRFO involves the potential for bighorn sheep to contract diseases, possibly leading to bighorn mortality events, after individual bighorns come into physical contact with domestic sheep or goats. As stated previously, there have been no confirmed cases of disease transmittals from domestic sheep to bighorns and no documented mortality events of native bighorns on the SJNF or TRFO. There is, however, strong circumstantial evidence of one bighorn mortality event on the SJNF involving exclusively translocated bighorns in 1988. All currently active domestic sheep allotments that are stocked annually on the SJNF have been stocked since the 1980s, and most have remained in their current allotment configurations since. Bighorn sheep summer use areas have also remained relatively consistent since the 1980s, with the exception of S-71, the West Needles Herd, which was established by releases in the Animas River Canyon between 2000 and 2003.

The LRMP does not make decisions concerning SJNF allotment status, but does identify lands (and allotments) that are available or grazing for BLM lands. The USFS conducts analyses and makes decisions concerning allotment status at the project implementation level using LRMP direction for guidance, and LRMPs provide a framework under which project-level decisions are made and LRMP direction is implemented. For this reason, the risk of physical contact between domestic and bighorn sheep on the SJNF and TRFO, and the risk for a bighorn mortality event, would remain under all alternatives prior to LRMP implementation. The LRMP contains strong direction in the form of standards to prevent the risk of physical contact between bighorn and domestic sheep. Therefore,

management actions associated with the livestock grazing program and recreational, special use, and invasive plant control programs using domestic sheep or goats may pose some level of risk to bighorn sheep individuals and populations within the planning area until LRMP standards and guidelines are implemented by individual projects and decisions. Within the LRMP, standards and guidelines would be the same for all alternatives, and standards would require project-level analyses to address the issue of potential for physical contact between domestic and bighorn sheep.

A Biological Evaluation (see Appendix T) analyzed the expected effects of LRMP implementation on bighorn sheep on the SJNF and compared the effects of LRMP alternatives. Differences among alternatives in SJNF allotment status and stocking are presented here to allow for a comparison of alternatives only and do not represent USFS decisions under the LRMP revision. Agency policy provides for these decisions to be made under project-level analyses during LRMP implementation. The differences between LRMP alternatives represent actions that could be proposed and considered under each alternative for project-level analysis and implementation following LRMP approval. All project-level proposals must meet LRMP standards and guidelines in order to make and implement these decisions. LRMP standards and guidelines are expected to provide direction for bighorn sustainability on the planning landscape for risk factors within SJNF jurisdictional control.

The SJNF Biological Evaluation found that Alternative B could maintain the same permitted numbers and area of domestic sheep grazing as Alternative A. For this reason, there would be little difference between Alternatives A and B in potential for physical contact between bighorn and domestic sheep. Under Alternative C, livestock grazing could be managed to enhance other resources including wildlife, cultural, and soils values, which could result in lower livestock stocking rates. Under Alternative C, domestic sheep numbers and suitable acres could be reduced compared to all other alternatives. Alternative C could therefore reduce the potential for physical contact between domestic and bighorn sheep, thereby also reducing the potential for a bighorn sheep mortality event during LRMP implementation, compared to Alternatives A, B, or D. Under Alternative D, livestock grazing could be managed to increase grazing opportunities and therefore could increase domestic sheep numbers. For this reason, Alternative D could result in greater potential for physical contact between domestic and bighorn sheep, with therefore also greater potential for a bighorn sheep mortality event, as compared to Alternatives A, B, or C. Because Alternative B offers the most big game winter range habitat improvement opportunities compared to Alternatives C, A, and D, Alternative B could have the greatest potential to improve habitat conditions for bighorn sheep.

<u>Impacts Related to White-tailed Ptarmigan Population Persistence</u>: A management challenge is to maintain or improve the amount and effectiveness of traditional ptarmigan winter use areas, especially those used by female ptarmigan, in the SJNF and TRFO portions of the Colorado ore belt. Maintaining and improving habitat effectiveness of traditional winter use areas for female ptarmigan is necessary to offset the toxic effects of cadmium-induced renal failure, causing reduced female survivorship, resulting in ptarmigan densities much lower in this area than other areas, and causing populations in this area to not be self-sustaining (Larison et al. 2000).

In response to this wildlife management challenge and habitat improvement opportunity, Volume II, LRMP, contains desired conditions, objectives, and guidelines in the abandoned mines and hazardous materials section to improve water quality and reduce the potential for heavy metal bioaccumulation in willows, as well as guidelines in the wildlife section to retain habitat capability in important ptarmigan winter areas. Water quality would be improved through remediation actions conducted by the abandoned mine program that reduce heavy metal concentrations, thereby reducing potential for bioaccumulation of heavy metals within willows in traditional ptarmigan winter use areas. Future abandoned mine program actions, and many past program actions, are focused on

the upper Animas River Basin, including the SJNF and TRFO portions of the Colorado ore belt where ptarmigan populations are thought to not be self-sustaining. In addition, LRMP standards and guidelines provide direction for winter recreation intended to maintain habitat effectiveness within ptarmigan traditional winter use areas for the purpose of providing habitat conditions capable of supporting self-sustaining ptarmigan populations. This would be accomplished through the identification of important ptarmigan winter use areas and consideration of measures, if necessary, to reduce disturbance, snow compaction, and physical damage to willows.

There would be no differences among the LRMP alternatives in projected outputs and activities in the abandoned mine and hazardous materials program area. LRMP implementation activities and projects to reduce toxic mine drainage are expected to continue in the upper Animas River Basin under all alternatives. All remediation activities would be expected to have at least minor long-term benefits for ptarmigan habitat capability through reductions in heavy metal uptake and bioaccumulation in willows.

Based on the total projected program area outputs for riparian and watershed improvement opportunities and aquatic and riparian habitat improvement opportunities, Alternative C would have the most potential to provide improved water quality and therefore the greatest potential for reduced heavy metal uptake and bioaccumulation by willows. This alternative would therefore provide the best opportunity for improving survivorship of female ptarmigan. Alternative B would propose somewhat fewer riparian and watershed improvement opportunities and aquatic and riparian habitat improvement opportunities than Alternative C. Alternatives D and A, respectively, would provide the least, but relatively similar, riparian and watershed and aquatic and riparian habitat improvement opportunities.

For winter recreation, Alternative A would maintain current management and many traditional ptarmigan winter use areas would remain available to winter motorized use. The overall trend of increased disturbance in important ptarmigan winter use areas and increased motorized access into ptarmigan winter use areas that were formerly undisturbed and untracked would continue, and ptarmigan winter habitat effectiveness would continue to decline in some areas.

Alternative C would have the most emphasis on non-motorized recreation and therefore would result in improved habitat effectiveness in some ptarmigan winter use areas resulting from reduced motorized use impacts, especially in areas that are further removed from primary highway mountain passes. Alternative A would have the most emphasis on motorized recreation and would result in reduced winter habitat effectiveness in those areas that would remain available to oversnow motorized use. On both BLM and NFS lands, the alternative that would best maintain ptarmigan winter habitat effectiveness, based on the amount of area not suitable for oversnow motorized travel, would be Alternative C, followed to a lesser extent by Alternative B, with Alternatives D and A being the least and very similar.

Across all program areas and activities on the SJNF and TRFO, Alternative C would be most likely to maintain habitat capability and effectiveness within ptarmigan historic winter use areas, followed by Alternatives B, D, and A, respectively. This is based on suitability for oversnow motorized travel and projected habitat improvement opportunities of riparian, aquatic, watershed, and abandoned mine program areas.

<u>USFS Management Indicator Species</u>

National forests are managed under an LRMP that establishes overall management direction including that intended to maintain healthy populations of fish and wildlife species. MIS are part of a

coordinated program with other parts of the LRMP that play a role in meeting NFMA requirements for biodiversity. The LRMP establishes goals, objectives, and monitoring requirements that are specific to MIS. At the LRMP level, MIS are established and utilized to help compare LRMP alternatives and monitor effects of LRMP implementation. Changes in MIS populations or habitats could indicate that current management is affecting the composition, structure, or function of associated habitats, or affecting the management issue for which the individual MIS was selected. This could result in indications that LRMP direction and desired conditions need to be revised or indicate the need for adjusting management actions under an adaptive management framework. Table 3.3.5 (above) shows terrestrial wildlife MIS selected, habitats of concern for each MIS, and the management issues addressed for the SJNF. Actions are proposed in conformance with the LRMP to maintain or achieve resource conditions that meet LRMP goals and objectives. Each action proposed by the agency would be analyzed in a manner that discloses its potential impacts to MIS habitat and population trends, and evaluates its consistency with the management direction contained in the LRMP.

Except for the cumulative impacts analysis, the concept of MIS does not apply beyond SJNF lands. The requirement to designate MIS or conduct assessments of effects to MIS does not apply to actions occurring on BLM lands. It should be recognized that the species selected as MIS on the SJNF also occur on adjacent BLM lands and that management actions on BLM lands contribute to maintaining healthy habitats and populations widely distributed across the region, as well as on the SJNF planning area. Because the MIS concept and requirement does not apply to BLM lands or management actions, the following MIS discussions apply only to lands and actions carried out by the SJNF.

The SJNF LRMP takes an ecological approach in the design of LRMP components to provide for ecosystem health and function, maintaining and improving the fundamental components necessary to achieve the desired conditions identified under the LRMP. MIS were chosen by the SJNF as a monitoring component for specific planning issues identified during the LRMP scoping process. No specific MIS standards or guidelines are designed into the LRMP for individual species. Instead, MIS are used as a tool for monitoring the effectiveness of other resource standards and guidelines and other referenced guidance that are intended to provide the ecological conditions needed to maintain habitats and populations for terrestrial wildlife as each MIS relates to the scoping issues they were selected for. Designating standards and guidelines to maintain habitat capability specifically for MIS would prevent the MIS from functioning as a tool for monitoring the planning issues for which they were selected. Some standards and guidelines designed to address management issues for sustainability of groups of species, such as big game and primary cavity excavators, would also be applied to several species that are also MIS, such as elk and hairy woodpecker. However, this LRMP direction was not developed because those species are MIS, but rather in the context of addressing a larger management issue outside the species' selection as an SJNF-wide MIS. Appendix M provides a detailed listing of LRMP components that provide for general species diversity and ecological integrity, thereby supporting species persistence and distribution across the planning area.

In general, the MIS analysis uses wildlife habitats and populations as the primary indicator of MIS trends. There are a variety of data sources acceptable for monitoring habitat and population trends of MIS, including but not limited to population estimates by state wildlife agencies, habitat inventory assessments, resource information system, activity/program reviews, and informed judgment of the USFS Wildlife Biologist. Monitoring requirements for MIS are limited to only those species and factors described in the LRMP.

The LRMP and associated planning documents do not provide site- or project-specific analysis. Instead, they provide the guidance for planning and implementing projects designed to move the land

base toward meeting and maintaining desired future conditions. Guidance is included for the habitat conditions and management issues for which MIS have been designated. Much of the direction concerning habitats for MIS is incorporated by reference from existing legislation, policy, manuals, handbooks, and BMPs. Direction contained in these documents is subject to change over time as new scientific information is developed that results in a better understanding of management and conservation techniques or from changes in authorities under legislation or policy.

For species designated as MIS on the SJNF, actions associated with the alternatives may benefit or adversely impact individuals as projects are implemented under LRMP direction. With the implementation of LRMP components that include mitigation, stipulation, and conservation measures for terrestrial wildlife species, the projected activities under all alternatives would not likely result in a detectible change to habitat trends or population trends for any MIS across the SJNF. Separate site- and project-specific NEPA analysis would occur as projects are proposed for implementation under the LRMP. Discussion of potential impacts from projected activities under each LRMP alternative to individual MIS follows below. Additional discussion concerning MIS and the LRMP supplement for fluid minerals is found in that analysis at the end of this Terrestrial Wildlife section.

Four species were selected as terrestrial wildlife MIS on the SJNF: Abert’s squirrel, American marten, elk, and hairy woodpecker. Due to their widespread distribution across the SJNF and the relative abundance of these four species on the administrative unit, their viability across the planning area (SJNF) is not of concern. Also due to their widespread distribution and abundance, their viability across the SJNF would not be threatened under any of the LRMP alternatives.

<u>Abert’s Squirrel</u>

Impacts Related to Influential Program Areas: Abert’s squirrel is considered well distributed throughout the SJNF in suitable ponderosa pine habitat. Habitat analysis shows the 20-year trend for suitable Abert’s squirrel habitat is stable, with a slight downward trend in optimal habitat. Population trends for the planning area are not thought to differ from the habitat trends, being generally stable with a possible slight downward trend (Keith 2003).

Most of the risk factors identified for Abert’s squirrel would be related to activities occurring within ponderosa pine and warm-dry mixed conifer habitats on the SJNF. Activities that could influence Abert’s squirrel populations and habitats include timber management, fire and fuels management (including prescribed burns, fire suppression, and understory mastication), oil and gas development, and livestock grazing. Other natural disturbance processes such as insects and disease may also impact the suitability of foraging and nesting trees.

All of the alternatives would provide the same management direction (including desired conditions, objectives, standards, and guidelines) for maintaining and improving the habitat conditions upon which Abert’s squirrel depend. This direction is expected to maintain healthy habitat conditions and well-distributed populations of Abert’s squirrel throughout the ponderosa pine and warm-dry mixed conifer habitat types within the planning area.

Impacts Related to Timber Management Decisions: For timber harvest activities in lower-elevation forests including ponderosa pine and to a lesser extent warm-dry mixed conifer where Abert’s squirrel is most abundant on the SJNF, Alternative C proposes the fewest acres of harvest, followed by Alternatives A and B, which project the same acres of harvest, then Alternative D, which projects the most harvest. Some timber harvest practices could have negative consequences for Abert’s squirrel habitat conditions, while other harvest practices, such as restoration treatments could have beneficial effects. Timber harvest activities may cause some temporary (5 years or less) impacts to individuals

in harvest activity areas, but restoration treatments are expected to be beneficial in the long-term (10 years or more) because projects are expected to move ecological conditions in ponderosa pine-dominated habitats closer to those expected under HRV. When coupled with prescribed fire treatments, restoration treatments in ponderosa pine-dominated habitats are expected to result in long-term improvements in the habitat conditions to which Abert's squirrel are most closely associated on the SJNF. A secondary potential impact of timber harvest activities involves the construction of roads, both permanent and temporary, and the potential for roads to reduce habitat capability for Abert's squirrel. LRMP design components are expected to provide guidance sufficient to maintain habitat capability for Abert's squirrel in relation to the management of roads in timber harvest project areas.

Impacts Related to Fire and Fuels Management Decisions: Under all LRMP alternatives, ponderosa pine and warm-dry mixed conifer systems would be a primary emphasis for fire and fuels activities. This is because past fire suppression and timber harvest activities have moved some stand structures and composition away from what was expected under HRV. Prescribed burns, in conjunction with timber treatments and understory mastication of Gambel oak (oakbrush) is expected to have long-term benefits for Abert's squirrel through moving stand conditions more towards those expected under HRV, conditions to which Abert's squirrel are most closely associated on the SJNF. Prescribed burns and timber and mechanical understory treatments may have temporary, short-term, negative impacts on Abert's squirrel populations and habitat capability, but these treatments are expected to result in long-term restoration benefits for the species. Fire suppression would continue to occur in some ponderosa pine stands due to their close proximity to the WUI where wildland fire use is not practical. For fire and fuels management treatments, there is little difference between the LRMP alternatives in projected activity outputs in ponderosa pine and warm-dry mixed conifer forests. Some temporary impacts to individuals may occur during project implementation, but long-term effects (10 years or more) on Abert's squirrel habitat conditions are expected to be primarily beneficial through movement of ecological conditions closer to those expected under HRV.

Impacts Related to Livestock Management Decisions: Within the planning area, livestock grazing is a widespread program activity in suitable rangelands. Much of the suitable habitat for Abert's squirrel is overlapped by rangelands suitable for cattle grazing. Most sheep grazing does not overlap Abert's squirrel habitat. In a general sense, livestock grazing may have indirect impacts on Abert's squirrel, if the activity influences the regenerative capabilities of ponderosa pine stands, truffle production in the understory of pine stands, and/or the fine fuels needed to promote restoration projects using prescribed burns. However, there are few, if any, measurable cause and effect relationships between livestock grazing and the maintenance of Abert's squirrel habitat, and for this reason grazing program effects to Abert's squirrel habitats are expected to be negligible. In general, the potential for impacts from livestock grazing activities would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing.

Summary: Actions associated with all alternatives could influence Abert's squirrel and/or its habitat. The LRMP components (including desired conditions, objectives, standards, and guidelines) are expected to provide for the ecological conditions in ponderosa pine-dominated habitats that would sustain healthy populations of Abert's squirrels well distributed across the SJNF. All LRMP alternatives are expected to include implementation actions designed to restore and improve the ecological conditions for which Abert's squirrel are adapted. These restoration actions, together with other activities within ponderosa pine stands, are expected to have a positive influence on the overall ecological conditions of habitats that Abert's squirrel depend on across the planning area. Across all

program areas, Alternative C is expected to have the most potential for maintaining and improving habitat conditions for Abert's squirrel, followed by Alternatives A and B, then Alternative D. Any project proposed under LRMP implementation would undergo separate site- and project-specific NEPA analysis, including an analysis of effects to MIS. Additional discussion concerning potential effects of fluid minerals is contained in the LRMP supplement found in that analysis section at the end of this Terrestrial Wildlife section.

American Marten

Impacts Related to Influential Program Areas: American marten are considered well-distributed throughout the SJNF within suitable habitat. Habitat trends are considered slightly upward with stable to slightly upward population trends (USFS 2004a). Most of the influential program areas for American marten would be specifically related to activities occurring within spruce-fir and cool-moist mixed conifer habitats on the SJNF. Program areas that could impact American marten habitats and populations include timber management, fire management, recreation (travel management and developed recreation sites), livestock grazing, and utility corridors. Other natural disturbance processes such as insects and disease could also impact habitat suitability for American marten.

All of the alternatives would provide identical management direction for American marten. This direction would include desired conditions, objectives, and standards and guidelines, as well as direction incorporated by reference. All of the alternatives would provide the same management direction (including desired conditions, objectives, standards, and guidelines) for maintaining and improving the habitat conditions that American marten are associated with on the SJNF. LRMP direction is expected to maintain healthy habitat conditions and well-distributed populations of American marten throughout the spruce-fir and cool-moist mixed conifer habitat types within the planning area.

Impacts Related to Timber Management Decisions: For timber harvest activities in higher-elevation forests including spruce-fir and cool-moist mixed conifer where American marten is most abundant on the SJNF, Alternative C proposes the fewest acres of harvest, followed by Alternatives A and B, which project the same acres of harvest, then Alternative D, which projects the most. Some timber harvest practices could have negative consequences for marten habitat conditions. Other harvest practices, such as those designed to reduce the impacts of large-scale disease or insect occurrences, could have long-term beneficial effects for marten habitat conditions by reducing the scale or intensity of tree mortality, thereby maintaining greater marten habitat capability compared to what otherwise might have occurred. Most timber harvest activities are likely to cause some temporary (5 years or less) impacts to individual marten in harvest activity areas, but treatments designed to replicate the small-scale natural disturbance processes typical of spruce-fir forests on the SJNF are expected to maintain habitat capability for marten across the planning area. More intensive treatments, however, could have mid- to long-term (20–100 years) impacts, depending on the amount of cover removed and the impacts to prey populations. A secondary potential impact of timber harvest activities involves the construction of roads, both permanent and temporary, and the potential for roads to reduce marten habitat capability. LRMP design components are expected to provide guidance sufficient to maintain marten habitat capability in relation to the management of roads in timber harvest project areas.

Impacts Related to Recreation Management Decisions: Historically, ski area development has resulted in impacts to marten habitat, including loss and reduction of breeding, foraging, and dispersal habitat, as well as overall increased disturbance with primary habitats. Snowmobiling, cross-country skiing, and snowshoeing in marten habitat may result in additional disturbances to foraging behaviors that may reduce the opportunity for successful foraging during a critical time of year. The alternatives

would provide for a range of oversnow travel suitability, ranging from no change under Alternative C, to an overall decrease under Alternative B, to increases under Alternatives A and D. Large expanses of suitable marten habitat exist on the SJNF within designated wilderness and other areas where motorized travel (winter and summer) is restricted. For that reason, much suitable marten habitat on the SJNF would not be affected by differences between the LRMP alternatives in relation to suitability for oversnow travel.

For summer motorized recreation, the acreage identified as suitable for motorized travel on the SJNF would be the greatest under Alternative D, slightly less for Alternative B, followed by Alternative A, and the least under Alternative C. The acreage identified as suitable-opportunity on the SJNF would be greatest under Alternative A, substantially less under Alternative D, followed by Alternative B, and the least under Alternative C. Alternatives B, C, and D would eliminate cross-country motorized travel. Eliminating cross-country motorized travel and limiting travel to a system of designated routes would substantially reduce the potential for disturbance to American marten, compared to the potential for disturbance in areas of unrestricted cross-country travel that would remain available under Alternative A. The projected activity levels of permitted outfitter and guide operations are not expected to vary by LRMP alternative and would continue under LRMP implementation. Developed recreation facilities including campgrounds, ski areas, and trailhead parking areas could reduce the availability of marten habitat and fragment otherwise larger more contiguous habitat patches. However, the relatively small scale of most developed recreation facilities is small in relation to the very large amount and expanse of suitable marten habitat available across the SJNF and therefore the degree of impact to marten habitat trends and population trends is expected to be very small. These developments may also result in greater disturbance to individual marten that may use the surrounding habitat; however, this disturbance is expected to be minimal. LRMP design components are expected to provide guidance in relation to decisions regarding developed recreation sites and motorized travel management sufficient to maintain suitable marten habitats well distributed across the planning area.

Impacts Related to Livestock Management Decisions: Livestock grazing typically occurs on the margins of marten habitat. Most cattle and domestic sheep grazing activities tend to avoid the mature closed-canopy forest stands that are preferred by American marten for foraging and resting, except when those stands are immediately adjacent to areas preferred for livestock grazing such as open grasslands, parks, and mountain shrublands. Domestic sheep grazing occurs along the edges of marten habitat where the tree line borders the subalpine zone. The potential impacts related to grazing on martens and/or their habitat are expected to be minimal. This is because there is very little overlap between grazing areas and suitable marten habitat.

The potential for impacts from livestock grazing activities to habitats preferred by American marten would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. Under Alternative D, livestock management may need to be more intensive and may require more investments in range improvements (including fencing, vegetation manipulation, and water developments) to avoid or otherwise mitigate potential impacts to resources such as riparian areas, wetlands, and spring and seep habitats. Alternative C would provide the most opportunity to remedy livestock grazing conflicts with other resources, because livestock grazing would occur on fewer acres and stocking rates would be lower than under any other alternative. LRMP design components relating to livestock grazing management and maintaining or improving the ecological conditions with which American marten are most commonly associated on the SJNF are expected to provide guidance sufficient to maintain suitable marten habitats well distributed across the planning area.

Impacts Related to Fire and Fuels Management Decisions: Generally, mechanical fuels treatments and prescribed burns are not performed in spruce-fir and cool-moist mixed conifer forests. There are no projected LRMP outputs for these program areas under any alternative. However, fire managed for resource benefit is likely to be used if fire starts can be maintained within prescription parameters. The fire regime for spruce-fir and cool-moist mixed conifer forests during HRV conditions was dominated by infrequent, high-severity, stand-replacement fires driven by regional-scale climate associated with prolonged drought and high winds (Romme et al. 1997). Fire frequency was longer than 200 years. During the long periods between fires, chronic fine-scale disturbances (including insects, disease, and wind) killed individual trees or small groups of trees (Veblen et al. 1991a). The current fire frequency regime of spruce-fir forests on the SJNF is within the HRV (Romme et al. 2009). Under all of the LRMP alternatives, fires managed for resource benefit could range from relatively small- to large-scale events annually in primary marten habitats. Because of the unpredictable nature, low return frequency, and often higher severity of fire regimes typical of subalpine forests under HRV, effects of fires managed for resource benefit to marten habitat conditions on the SJNF is expected to be affected more by regional-scale climate and drought conditions, and less by management actions related to LRMP implementation activities. The expected impacts related to fires managed for resource benefit to marten habitats could include short- to midterm (5–10 years) reductions in breeding and foraging habitats due to the removal of overstory forest cover and dead and down woody material. Over time, fires managed for resource benefit are expected to occur within the range of fires expected under HRV, thereby promoting the maintenance and regeneration of habitat conditions to which the marten is adapted. In general, however, under Alternative A fire managed for resource benefit, including the occurrence of an infrequent high-severity event, is likely to affect only relatively small amounts of marten habitat compared to the very large amount of suitable marten habitat available across the SJNF. There is no difference in the projected outputs for fire managed for resource benefit under Alternatives B, C, and D, and therefore no differences would be expected under these alternatives.

Impacts Related to other Activities: Other proposed management activities within the planning area include Special Use Permits and oil and gas lease developments. These activities would usually be very small in scale or are expected to result in only very minor impacts to marten habitat quantity, quality, or habitat capability. For example, very little oil and gas development occurs in suitable marten habitat, and thus oil and gas activities are unlikely to affect marten habitat to the extent they cause detectible changes to SJNF-wide habitat or population trends. Special Use Permits, such as for private land access could cause site-specific disturbances to individual martens and could influence marten habitat conditions if new road construction was approved, but the scale of these projects is typically smaller than the average marten home range size and thus effects are expected to be very small in scale and thus unlikely to affect overall marten habitat or population trends. Indirectly, new road construction may also result in additional winter motorized use that could, in turn, result in greater disturbances within suitable marten habitat, but these effects are also expected to be very small in scale and limited in duration and therefore unlikely to affect overall marten population trends.

Under all of the alternatives, the habitat trend for American marten is expected to remain stable during the timeframe associated with LRMP implementation. Due to the decrease over time in timber harvesting activities within the spruce-fir and cool-moist mixed conifer habitat types, as well as the large amount of late successional suitable habitat available across the SJNF, a stable to increasing population is expected to continue for the life of the LRMP. Natural disturbance events including high-intensity wildfire or insect epidemics could negatively impact marten habitat, but the scale and intensity of these potential impacts are not reliably predictable at this time. Suitable marten habitat is expected to remain well-distributed and abundant across the SJNF and sufficient to provide for persistent and viable populations.

Summary: Actions associated with all alternatives could influence the American marten and/or its habitat. However, projected outputs under all alternatives conform to the provisions described in LRMP. The LRMP components (including desired conditions, objectives, standards, and guidelines) would include mitigation, stipulation, and conservation measures that are expected to provide for the ecological conditions in spruce-fir and cool-moist mixed conifer forests that would sustain healthy populations of American marten well distributed across the SJNF. Overall habitat and population trends are expected to remain stable, or to slightly increase, across the planning area over the life of the LRMP. Across all program areas, Alternative C is expected to have the most potential for maintaining or improving habitat conditions for American marten, followed by Alternatives A and B, then Alternative D. Any project proposed under LRMP implementation would undergo separate site- and project-specific NEPA analysis, including an analysis of effects to MIS.

Elk

Impacts Related to Influential Program Areas: Elk are a generalist species that occur in a variety of habitat types across the SJNF. They are considered well-distributed throughout the planning area within the range of suitable habitats that they occupy, which varies by season. Habitat analysis shows the 20-year SJNF-wide trend for summer range is stable, with an upward condition trend on winter ranges. Population trends have increased from the lows experienced during the 1980s. Currently, the elk population is considered stable (SJNF Elk Species Assessment [USFS 2004b]). It is believed that elk populations on the SJNF are influenced primarily by hunter harvest rates, which are set by CPW.

On the SJNF, elk have ample summer range that provides forage, thermal and hiding cover, and calving grounds. During winter, however, they become concentrated on lower-elevation ranges (Wolfe et al. 2002). These areas primarily occur on the SJNF below about 8,000 feet, although the upper elevation limit fluctuates depending on seasonal snow depth. Undisturbed winter range areas that are in healthy ecological condition are critical in providing habitat on the SJNF sufficient to support CPW's big game population objectives. Winter range extends across the southern and western portions of the SJNF and onto a variety of adjacent land ownerships including BLM, state, tribal, and private lands. While winter range is extensive across all ownerships, it is not equal to the quality and extent of summer range on the SJNF, and it is believed that winter range amount and habitat effectiveness could become a limiting factor to elk populations in the future. During the winter months elk become concentrated on winter ranges that are much more limited compared to the extent and amount of summer range available on the SJNF. A variety of forest management activities occur on elk winter ranges and these relatively limited wintering areas are increasingly being influenced by human development and other uses on lands adjacent to SJNF lands. Because of concerns for maintaining the extent and capability of elk winter ranges on SJNF lands, the general risk factors identified for elk are primarily tied to activities and influences associated with low-elevation winter habitats including pinyon-juniper, ponderosa pine, mountain shrubland, and sagebrush shrubland habitats. LRMP implementation influential activities include timber management, fire and fuels management, oil and gas development, recreation, travel management, and livestock grazing program areas. Other natural disturbance processes such as insects and disease may also influence the suitability of thermal cover on winter ranges.

All of the alternatives would provide the same management direction (including desired conditions, objectives, standards, and guidelines) for maintaining and improving habitat conditions for elk, especially on important winter ranges. This direction is expected to ensure that habitat conditions on the SJNF, especially on limited winter ranges, are sufficient to support the population objectives established by CPW. LRMP direction is expected to maintain the healthy habitat conditions necessary to support the current elk populations that are well-distributed across the planning area.

Impacts Related to Timber Management Decisions: Timber management activities overlapping elk winter range are primarily associated with the ponderosa pine and warm-dry mixed conifer habitat types. Some timber harvest practices could have negative consequences for conditions on elk winter ranges, while other harvest practices, such as restoration treatments could have beneficial effects for elk winter range. Timber harvest activities may cause some temporary (5 years or less) impacts to individuals in harvest activity areas, but restoration treatments are expected to be beneficial in the long term (10 years or more) because projects are expected to move ecological conditions in ponderosa pine–dominated habitats closer to those expected under HRV. When coupled with prescribed fire treatments, restoration treatments in ponderosa pine–dominated habitats are expected to result in long-term improvements in the habitat conditions on elk winter ranges on the SJNF. A secondary potential impact of timber harvest activities involves the construction of roads, both permanent and temporary, and the potential for roads to reduce habitat capability for elk, especially on winter ranges during the winter season. LRMP design components are expected to provide guidance sufficient to maintain habitat capability for elk in relation to the management of roads in timber harvest project areas. For timber harvest activities in the ponderosa pine and warm-dry mixed conifer forests that dominate elk winter ranges on the SJNF, Alternative C proposes the fewest acres of harvest, followed by Alternatives A and B, which project the same acres of harvest, then Alternative D, which projects the most harvest. For timber harvest activities in higher-elevation forests including spruce-fir and cool-moist mixed conifer where most elk summer range is located on the SJNF, Alternative C proposes the fewest acres of harvest, followed by Alternatives A and B, which project the same acres of harvest, then Alternative D, which projects the most harvest.

Impacts Related to Fire and Fuels Management: Under all LRMP alternatives, ponderosa pine and warm-dry mixed conifer systems would be a primary emphasis for fire and fuels program area activities. This is because past fire-suppression and timber harvest activities have moved some stand structures and composition away from what was expected under HRV. Prescribed burns, in conjunction with timber treatments and understory mastication of Gambel oak (oakbrush) is expected to have long-term benefits for elk by moving stand conditions more towards those expected under HRV and improving elk forage conditions on winter ranges. Prescribed burns and timber and mechanical understory treatments may have temporary, short-term, negative impacts on elk winter habitats due to project-related human activities and disturbance to wintering animals, but these negative effects are expected to be short in duration and very limited in scale, resulting in only minor local impacts to a relatively small number of individual animals. A potential negative effect of fire and fuels management projects is loss of dense hiding cover located along motorized routes, which could cause short- and long-term increases human disturbance in proximity to designated routes within project areas, increasing the exposure of animals to hunter harvest and potentially reducing use of those areas by big game animals (Montgomery et al. 2012). A secondary potential impact of fire and fuels treatment activities involves the construction of roads or clearing of motorized routes to access project work areas. Routes used by these projects can be both permanent and temporary. These routes have the potential to reduce habitat capability for elk, especially when animals are present on winter ranges during the winter season. LRMP design components that apply to all alternatives are expected to provide guidance sufficient to maintain habitat effectiveness for elk in relation to the management of roads and other motorized routes in elk winter ranges. In general, however, these fire and fuels management treatments, including understory mastication projects, are expected to quickly provide improvements in elk winter range forage capacity and also result in long-term (10 years or greater) restoration benefits for elk through moving habitat conditions towards those that more closely resemble conditions under HRV. Fire suppression would continue to occur in some ponderosa pine stands due to their close proximity to the WUI where prescribed fire is not practical. For fire and fuels management treatments, there is little difference between the LRMP alternatives in projected activity outputs in ponderosa pine and warm-dry mixed conifer forests. Some temporary impacts to individual

animals may occur during project implementation, but long-term effects (10 years or more) on habitat conditions for elk winter ranges on the SJNF are expected to be primarily beneficial through movement of ecological conditions closer to those expected under HRV.

Impacts Related to Livestock Management Decisions: Within the planning area, livestock grazing is a widespread program activity in suitable rangelands. Much of the elk winter range on the SJNF is overlapped by rangelands suitable for cattle grazing. Most sheep grazing does not overlap elk winter range. The potential for negative effects of cattle grazing on elk winter range relates to the amount of forage remaining for elk after the livestock grazing season has ended. In areas where sufficient forage remains at the beginning of the winter season, impacts of livestock grazing on elk habitat capability is minimal. When grazing is used as a management tool to restore grassland health, cattle may result in positive influences to elk winter range. Negative influences on elk winter range may also occur if summer or fall grazing affects plant vigor or reduces the amount of post-grazing regrowth following the grazing season, reducing the amount of forage available to elk during the winter season. In general, the potential for impacts from livestock grazing activities would be greatest under Alternative D because it proposes the most acres as suitable for livestock grazing, followed by Alternatives A and B, which propose relatively similar acres as suitable for grazing, then Alternative C, which proposes the least acres as suitable for livestock grazing. Under Alternative D, livestock management may need to be more intensive and may require more investments in range improvements (including fencing, vegetation manipulation, and water developments) to avoid or otherwise mitigate potential impacts to resources such as riparian areas. Alternative C would provide the most opportunity to remedy livestock grazing conflicts with other resources, because livestock grazing would occur on fewer acres and stocking rates would be lower than under any other alternative. LRMP design components relating to livestock grazing management and maintaining or improving the ecological conditions in ponderosa pine and warm-dry mixed conifer forests are expected to provide guidance sufficient to maintain suitable habitat conditions on elk winter ranges that are well distributed across the planning area.

Impacts Related to Recreation and Travel Management Decisions: The most important habitat factor for elk populations that summer on the SJNF is the amount of available winter range. Much of the winter range that elk depend on occurs across a mosaic of land ownerships including federal, state, and private landowners. On adjacent private land residential development and human population growth has reduced the availability of some traditional winter range areas. This is more pronounced within close proximity of population centers. Roads and other infrastructure have further dissected available habitats and/or reduced habitat security. This trend of declining elk habitat availability on adjacent non-federal lands has increased the importance of some winter range areas on the SJNF, but many elk winter areas on the SJNF are also seeing increased winter recreation use that can reduce elk habitat effectiveness (Lyon and Christensen 2002).

Winter range is considered to be the most important habitat factor for elk on the SJNF. Within the planning area, some winter range areas are closed to motor vehicles by snow conditions or existing seasonal restrictions during the period of use by big game animals. Alternative A continues to permit areas of cross-country motorized travel over ground, thereby having the greatest potential for impacts to big game animals on winter ranges. Alternative A also has more lands available for overground motorized uses than do Alternatives B, C, and D. Under Alternatives B, C, and D, implementing a system of designated roads and trails for motorized travel over ground would have beneficial impacts to the effectiveness of elk winter habitats by reducing the potential for disturbance to wintering animals. Areas available for motorized travel over snow would remain unchanged under Alternative A. There would be a reduction in area available to oversnow travel under Alternative C, with smaller reductions occurring under Alternative B and D. For these reasons Alternative A has the greatest

potential to negatively affect elk habitat capability, followed by Alternatives D, B, and C, respectively. LRMP design components that apply to all alternatives are expected to provide guidance sufficient to maintain habitat effectiveness for elk in relation to the management of roads and motorized trails in elk winter ranges.

Summary: Actions associated with all alternatives could result in impacts to elk habitats, including winter range. LRMP components (including desired conditions, objectives, standards, and guidelines) would include mitigation, stipulation, and conservation measures that are expected to provide for the ecological conditions necessary to support CPW's elk population objectives across the SJNF over the life of the LRMP. LRMP components are expected to sustain viable elk populations well distributed across the planning area. All alternatives include specific actions designed to restore and improve habitat conditions on elk winter ranges. Under all of the alternatives, no change is expected in the current stable trend of summer habitat conditions and upward trend in winter habitat conditions across the SJNF. The alternatives could influence the rate of change of habitat conditions, but no correlation has been found between habitat trends and population trends over time on the SJNF. Therefore, no change is expected to the currently stable overall population trend for elk resulting from habitat management actions during LRMP implementation. At this time, CPW population management, through regulating hunter harvest, is believed to have the greatest influence on elk population trends on the SJNF. Projects proposed under LRMP implementation would undergo separate site- and project-specific NEPA analysis, including an analysis of effects to MIS and effects to elk winter range. Additional discussion for elk concerning fluid minerals and the supplement is found in that section at the end of this Terrestrial Wildlife section.

Across all program areas and activities on the SJNF, Alternative C would be most likely to maintain habitat capability and habitat effectiveness on elk winter ranges, followed by Alternatives B, D, and A, respectively. This is based on suitability for motorized travel and projected outputs for timber, fire and fuels, livestock grazing, travel management, and recreation program areas.

<u>Hairy Woodpecker</u>

Impacts Related to Influential Program Areas: The hairy woodpecker is considered well-distributed and relatively abundant across the SJNF within a wide variety of forested habitat types. Hairy woodpeckers are dependent on standing snags and live green trees with heart rot for constructing nesting cavities or as primary foraging substrate. They are a primary cavity nester, excavating a new cavity yearly. Many other species of birds and some bat species that cannot excavate their own cavities depend on abandoned woodpecker nest cavities for nesting or roosting sites. On the SJNF, hairy woodpecker nests are constructed in suitable live trees and standing snags greater than about 16 inches dbh within most forested habitat types, but they show a preference for aspen stands. Current information suggests hairy woodpecker populations have increased slightly in Colorado, as well as throughout their entire range. Recent habitat modeling and density-estimate evaluations suggest that the population trend of hairy woodpecker on the SJNF is stable or slightly increasing (SJNF Hairy Woodpecker Species Assessment [USFS 2004c]).

In general, program areas with potential to impact hairy woodpecker habitat are those programs that cause or facilitate, directly or indirectly, the loss of standing snags, especially those snags greater than about 16 inches dbh (Bull et al. 1997; Parks et al. 1997; Schultz 2001). LRMP components would protect and maintain standing snags, especially large-diameter snags (greater than about 16 inches dbh). Risk factors identified for hairy woodpecker would be related to management activities within aspen and mixed conifer habitats, and activities that influence the abundance and/or distribution of standing snags or live trees with heartwood rot. Program areas that could influence hairy woodpecker populations and habitats include timber management, fire and fuels projects,

firewood harvesting, livestock grazing activities, and fluid minerals development projects. Other natural disturbance processes, including insects and disease, could also influence the amount and extent of woodpecker habitat.

All of the alternatives would provide the same management direction (including desired conditions, objectives, standards, and guidelines) for maintaining and improving the abundance and distribution of standing snags, especially those greater than about 16 inches dbh, and live trees with heartwood decay, which provide the primary substrate for hairy woodpecker nesting and foraging habitats. This direction is expected to maintain healthy habitats for hairy woodpecker and the current well distributed and relatively abundant nature of woodpecker populations throughout aspen and mixed conifer habitats across the SJNF.

Examples of program areas that have the potential to reduce the abundance or distribution of large-diameter standing snags, or indirectly facilitate the loss of snags, include travel management, timber resources, fire and fuels, and solid and fluid minerals. Other activities, such as watershed/fisheries improvements, livestock grazing, and invasive plant species treatments, might also indirectly influence the distribution and/or abundance of large-diameter standing snags. However, the impacts related to these other activities are expected to be site specific in nature and are likely to only impact very small numbers of snags in very limited areas. For this reason, they are unlikely to result in impacts to population sustainability of snag-dependent birds across the planning area. Effects from these other program areas are expected to be so small and site-specific that they would not cause detectible changes in abundance or distribution of snag-dependent birds across the SJNF.

Impacts Related to Travel Management Decisions: Travel management projects, timber projects, and oil and gas projects that could develop new access, or substantially improve existing access, to areas that currently have higher densities of large-diameter standing snags (including riparian areas and ridge tops) may indirectly facilitate increased losses of snags to personal use firewood gathering. This potential impact would be likely to degrade habitat value for hairy woodpecker. Restricting off-road motorized travel to designated routes would likely protect existing snags, especially those large-diameter snags greater than 300 feet from roads, by reducing accessibility for personal use firewood harvesting of snags that are greater than 300 feet from roads. Alternative A continues to permit areas of cross-country motorized travel, thereby having the greatest potential for loss of large-diameter snags to firewood harvesting. Alternative A also has more lands available for overground motorized uses than do Alternatives B, C, and D. Under Alternatives B, C, and D, motorized travel would be restricted to a system of designated routes, likely benefiting woodpeckers by reducing the potential for loss of large-diameter snags greater than 300 feet from designated motorized routes. This would influence large areas, especially on the west side of the SJNF, that are currently open to cross-country motorized travel.

Impacts Related to Timber Management Decisions: Timber harvest and fire and fuels management projects are likely to result in the greatest potential for direct and indirect impacts to habitats for hairy woodpecker, compared to other agency program areas. Timber harvest may negatively impact snag-dependent birds by reducing snag densities through the removal of snags for safety of operations during timber harvest. Clearcut harvest methods are generally used in aspen-dominated forests to regenerate older decaying aspen stands. After harvest, stands are unsuitable for woodpeckers and other secondary cavity-nesting birds for the long term until overstory trees reach greater than about 9 inches dbh in size. LRMP standards and guidelines would reduce the potential for snag loss during timber harvesting activities. LRMP components would be the same under all of the alternatives and are expected to protect and maintain large-diameter snags and increase recruitment of large-diameter replacement snags.

For hairy woodpecker, potential effects of timber program activities would vary by alternative and by the forested habitat type. For birds associated with ponderosa pine habitats, warm-dry mixed conifer habitats, and spruce-fir habitats, Alternatives A and B have similar projected timber program outputs. Alternative C has slightly less projected program outputs, and Alternative D has the most projected program outputs. For birds associated with cool-moist mixed conifer habitats, Alternative C has the least projected program outputs, followed by Alternatives B, A, and D, respectively. For birds associated with aspen-dominated habitats, Alternative C has the least projected program outputs, followed by Alternatives A, B, and D, respectively.

Impacts Related to Fire and Fuels Management Activities: Prescribed burns are often used to treat understory hazardous fuel conditions and reduce slash following timber projects. Projected outputs for prescribed fire projects are expected to be similar across all alternatives. Prescribed fire is frequently used as a follow-up treatment in ponderosa pine and warm-dry mixed conifer forests, and often results in the loss of soft snags from flying embers catching in the crowns of large-diameter standing snags. Conversely, prescribed fire can also create new snags when burn intensities are high. However, because large-diameter trees (greater than 16 inches dbh) are less susceptible than small-diameter trees to being killed by prescribed fires conducted under normal burn parameters, most snags created by agency prescribed fires are too small to provide high-quality nesting habitat for cavity-dependent birds such as hairy woodpecker. The generally small-diameter snags often created by prescribed fire killing understory trees are usually much smaller in diameter than the soft snags often lost during the burn, and therefore the net habitat value for cavity-dependent birds such as hairy woodpecker generally declines following prescribed burns. Burns do, however, create short-term woodpecker foraging habitat, but benefits of foraging habitat rarely extend past about 5 years post-burn due to rapid declines in insect abundance. Some portions of the planning area are considered to have snag densities well below levels necessary to sustain populations of snag-dependent birds. As a result, the Pagosa and Columbine Ranger Districts implemented bans on cutting large-diameter ponderosa pine snags for personal use firewood.

For reasons described above, fuel treatment project impacts to hairy woodpecker would depend primarily on maintaining and creating large-diameter snags. Over the long term (more than 30 years), fuel treatment projects could result in higher rates of recruitment of large-diameter trees that could ultimately become snags because LRMP components would favor the retention of large-diameter snags and live snag replacement trees, as well as the restoration of ecosystem function (including disturbance processes, such as natural fire). Because there is little difference between the alternatives in the projected output acreage of fuel treatment projects, there may be little difference between the alternatives in potential program impacts to hairy woodpecker habitat from fuel treatment projects.

Impacts Related to Livestock Management Decisions: Within the planning area, livestock grazing is a widespread program activity in suitable rangelands, with approximately 115,242 cattle and 11,437 sheep AUMs occurring on NFS lands. Most sheep grazing occurs in high-elevation alpine systems and does not overlap hairy woodpecker habitat within aspen. However, cattle grazing may occur in aspen stands, and could, therefore, indirectly impact hairy woodpecker habitat. Livestock grazing might result in indirect impacts to hairy woodpecker if the activity influences the regenerative capabilities of the aspen stands, especially after treatment, when the young shoots are growing. Standards, guidelines, and monitoring programs would be in place in order to minimize these impacts and correct them if they represent a management problem.

Impacts Related to Mineral Development Decisions: Most fluid minerals development on the SJNF would likely occur in the ponderosa pine, pinyon-juniper, and warm-dry mixed conifer habitat

types. Fluid minerals development may slightly reduce habitat quality for hairy woodpecker, but the level of impact is expected to be minor to moderate, and the scale of impacts is expected to be localized and very small, depending on habitat type, past management history, and degree of public access, both before and after project development. LRMP components favor the retention of large-diameter snags and live snag replacement trees, and favors the restoration of ecosystem function (including disturbance processes, such as natural fire), thereby minimizing the potential impacts to hairy woodpecker habitat during LRMP implementation. Acres of federal minerals available for leasing are fairly similar across Alternatives A, B, and D. Alternatives A, B, and D open the largest amounts of federal minerals to leasing; Alternative C opens substantially fewer amounts of federal minerals to leasing. Under the No Leasing Alternative, development would be limited to existing leases within the planning area.

Summary: In general, Alternative C would have the least potential for impacts to habitat components for hairy woodpecker, followed by Alternatives B, D, and A, respectively. This is based on the projected output amounts under each alternative for program areas that are likely to reduce the abundance or affect the distribution of large-diameter standing snags and live trees with heartwood rot. Some of the actions associated with all of the alternatives may have influences to the hairy woodpecker and/or its habitat. However, the projected outputs under all of the alternatives would conform to the provisions described in the LRMP/FEIS. LRMP components and mitigation, stipulations, and conservation measures would provide for viable populations of hairy woodpecker. The management actions that may occur in aspen stands would most likely have short- to midterm impacts on individual hairy woodpecker. However, long-term restoration benefits are expected from the regeneration of selected older stands. No change to the current stable population and habitat trends is expected across the SJNF under any of the alternatives. Separate site- and project-specific NEPA analysis, including MIS analysis, would occur as projects are proposed for implementation. Additional discussion for this species concerning fluid minerals and the supplement is found in that section at the end of this Terrestrial Wildlife section.

<u>Cumulative Impacts Related to Influential Program Areas on Management Indicator Species</u>

Actions taken to implement any of the alternatives, along with past, present, and reasonably foreseeable future activities undertaken by the SJNF or other ownerships may result in combined or cumulative impacts to the MIS selected by the SJNF. However, all alternatives would be limited by LRMP components designed, in part, to account for potential cumulative impacts of activities occurring on adjacent ownerships or from the combined effects of all program activities on lands managed by the SJNF. After considering direct, indirect, and cumulative effects to MIS, LRMP components are expected to provide the ecological conditions necessary to maintain populations of all native and desired non-native wildlife species well-distributed across the SJNF. LRMP components that address MIS and wildlife diversity are also founded in law, federal regulation, and policy that allows for periodic reviews and adjustments of the LRMP, as needed, and as new information becomes available.

Currently, human populations near the planning area are projected to continue growing for the foreseeable future. This trend, and the associated increased demand for a wide variety of forest products and recreational opportunities across the SJNF, may be one of the largest wildlife management challenges facing LRMP implementation. For spruce-fir associated MIS, such as the American marten, cumulative impacts associated with other land ownerships may include increased habitat fragmentation (due to highway infrastructure improvements and increased traffic volume, use and development of private in-holdings, mining activities on claim in-holdings, access across NFS lands to private in-holdings, etc.). Increased development of adjacent private lands around ski areas

on NFS lands and expanded recreational pursuits by adjacent homeowners at private base area developments may also reduce habitat capability for MIS species move across the landscape irrespective of land ownership boundaries. However, the majority of spruce-fir forest occurs on NFS lands, with relatively large and unroaded expanses occurring within backcountry and designated wilderness areas that are expected to provide large blocks of high-quality source habitats for MIS species such as American marten. Expanses of summer range for elk are also expected to remain available in the high-elevation spruce-fir and cool-moist mixed conifer forests within the planning area.

For MIS associated with lower-elevation ponderosa pine and warm-dry mixed conifer forests, such as Abert's squirrel, large amounts of suitable habitat are well distributed across SJNF lands. Much of these habitat types on other adjacent land ownerships has been heavily modified due to past management impacts. Potential cumulative impacts to MIS species associated with lower-elevation forested habitats are expected to be reduced by the LRMP's increased emphasis on restoration activities within ponderosa pine and warm-dry mixed conifer systems. Restoration activities are expected to improve ecological function in these forests, thereby improving habitat conditions for MIS associated with these forests,

In relation to elk, a wide-ranging MIS that is associated with many different habitats at different times of the year, human population increases and associated development of adjacent private lands is expected to place additional pressures on SJNF lands to replace high-quality undisturbed elk wintering habitats that are being lost from adjacent private lands. Improving the capability of elk wintering habitats on SJNF lands to compensate for the gradual loss in habitat effectiveness of adjacent private lands is becoming more important to ensure public lands sustain elk populations sufficient to meet CPW's herd population objectives. Much of the Gothic Shale formation and Paradox Basin oil and gas development potential areas lies within elk winter range on private lands adjacent to the Dolores River and to the east and south of the town of Dolores. The potential for fluid minerals development is high on these private lands, with associated potential for increased impacts to elk winter ranges that occur across these lands. Low-elevation lands are also currently being used by a wide variety of utility infrastructure corridors including electric, natural gas, and fiber-optic communications. The need for additional utility infrastructure transportation corridors is expected to continue growing for the foreseeable future. Past and current emphasis on wildlife mitigation has increased the number and extent of fire and fuels mitigation projects implemented on adjacent private lands in the WUI. These projects also impact wintering habitats for elk, potentially in both positive and negative ways, as described above. Cumulative effects to elk herds that use the SJNF could result from all of these activities and developments in elk winter ranges on private lands adjacent to the SJNF. For this reason, LRMP components have been designed to consider these potential cumulative influences on MIS that occur on SJNF lands, increasing the importance of working collaboratively with CPW and other adjacent landowners as needs develop.

No LRMP alternative is expected to result in cumulative impacts to any MIS that uses the SJNF planning area of sufficient extent or magnitude to result in detectible changes to population or habitat trends across the SJNF. LRMP monitoring requirements and adaptive management principles are expected to help identify changes in MIS populations and habitat trends on the SJNF and guide decisions about the potential need for management changes on the SJNF to address unanticipated cumulative impacts over the life of the LRMP.

3.3.4 *Fluid Minerals Leasing Analysis*

The following section summarizes the potential impacts of the leasing alternatives on terrestrial wildlife. This analysis is based on assumptions regarding how the PLAA would develop if, when, and where additional lands are made available for lease. Lands made available for lease would be subject to standard lease terms and, where deemed necessary, special lease stipulations to protect wildlife species and their habitats. Leasing stipulations and LRMP components are designed to minimize and/or mitigate potential impacts of oil and gas leasing and subsequent development to wildlife species and the habitats on the SJNF and TRFO on which they depend. Impacts to wildlife species, habitats and key habitat components would be analyzed in detail at the site-specific level in a plan of development if and when lands are leased and before development is approved.

Oil and gas leasing and subsequent development could have the following impacts to terrestrial wildlife species and habitats:

- Direct loss of habitat from conversion to well pads, roads, pipeline and utility corridors, and ancillary facilities such as pipeline compressor stations;
- Reduced habitat effectiveness and habitat fragmentation from construction activities and activities associated with operation of oil and gas facilities;
- Persistent operational impacts causing disturbances to wildlife when they are using important seasonal ranges, such as big game winter concentration and parturition areas;
- Disruption of migratory routes from habitat loss and fragmentation, and reduced habitat effectiveness due to disturbance and displacement effects within migratory routes at key times of year caused by development and operational activities; and
- Direct mortality due to vehicle collisions.

Effects to wildlife species and habitats from subsequent development as a result of oil and gas leasing could occur in a variety of ways, including:

- Construction of roads, well pads, and other ancillary facilities could result in direct loss of wildlife habitats, potentially reducing the amount, distribution or diversity of available key habitat components such as forage and hiding and thermal cover in the affected area. There could also be an indirect loss of habitat capability due to introduction/expansion of invasive plant species at and near construction sites, and loss of habitat function before interim reclamation projects provide usable hiding, nesting, forage, and security cover. Application of conservation measures found in the LRMP standards and guidelines, additional referenced guidance, and Appendix H leasing stipulations are designed to minimize and/or mitigate potential impacts to wildlife habitats and species from the direct and indirect loss of habitats and habitat capability.
- Construction and operation of oil and gas facilities could result in the fragmentation of wildlife habitats in the projected development areas. Oil and gas development and production activities have the potential to result in negative effects on habitats for some wildlife species. Application of Appendix H leasing stipulations, LRMP standards and guidelines, and recommendations of additional referenced guidance is expected to minimize and/or mitigate fragmentation effects to wildlife habitats. Fragmentation could occur as a result of road, well pad, and oil and gas facility construction. The effects of habitat fragmentation would vary by species of wildlife and by the relationship between facility infrastructure and key habitat components for individual wildlife species. For some wildlife species, such as those that are small and less mobile (e.g., rodents, reptiles, and amphibians) fragmentation that occurs at relatively small geographic scales could

disrupt movement and reduce connectivity between individuals or populations, increasing the potential for small-scale population isolation or perhaps extirpations. For other species, such as those that are larger and more mobile (e.g., deer and elk), fragmentation associated with projected levels of oil and gas development is unlikely to isolate populations or result in localized extinctions. For mobile species, however, habitat fragmentation and resulting displacement effects would require the application of leasing stipulations, LRMP standards and guidelines, and mitigation measures from additional referenced guidance to ensure that potential population-level effects would be minimized.

- Increased human activity, equipment operation noise, vehicular traffic, and noise resulting from all phases of oil and gas development and production operations could cause wildlife to be displaced from areas of presumably higher habitat capability to areas of presumably lower habitat capability or cause animals to stop using the area altogether. Habitat displacement or avoidance could result in the under-utilization of otherwise suitable habitats and reducing the effectiveness of otherwise suitable habitats. Habitat avoidance could also reduce the recreational values of areas where wildlife uses are reduced or avoided, such as reducing values of the area for watchable wildlife or hunting. Wildlife distribution patterns could be altered, leading to increased competition by wildlife for limited resources and potential for overuse of the areas into which larger numbers of animals are displaced.
- Increased public access from oil and gas development roads could potentially lead to increased legal hunting pressure and poaching, which could have both positive and negative effects on state wildlife management objectives for individual big game herds.
- Increased vehicle traffic would be expected during all phases of oil and gas development under each alternative. The potential for vehicle collisions with wildlife species is directly correlated to the volume of traffic and road type. Project-related traffic volume is likely to be greatest during the construction phase and diminish during the production and abandonment phases. Indirectly, increased traffic volumes are also likely to increase disturbance to animals within surrounding areas, potentially increasing displacement of animals out of areas surrounding roads with higher traffic volumes to areas around roads with lower traffic volumes. As animals are displaced they could face increased risk of mortality while attempting to cross other higher volume roads while en route to more secure areas.
- Adverse impacts to wildlife habitats associated with oil and gas development are expected to be long term (life of the LRMP). Predicted timeframes for oil and gas development are to complete drilling activities within 15 years. From the time of completion, wells may continue to produce for 30 years after that. However, once well production is complete, well pads and associated roads and other infrastructure are expected to be removed and the areas reclaimed.

Terrestrial Wildlife Lease Stipulations

Many leasing stipulations found in Volume III, Appendix H and displayed below in Table 3.3.6, were designed to maintain and protect wildlife habitat capability and effectiveness within areas that could be leased for fluid mineral development during LRMP implementation. Wildlife-related lease stipulations are consistent with LRMP standards and guidelines and other referenced direction. These stipulations apply to currently unleased lands as they are considered for leasing. Both leased and unleased lands must be consistent with all direction found within the LRMP during subsequent site-specific NEPA analysis and documentation (IM CO-2010-027 [BLM 2005b]).

Table 3.3.6: Wildlife Lease Stipulations

Wildlife	Alt A	Alt B	Alt C	Alt D
Mexican spotted owl	NSO, LN	NSO, LN	NSO, LN	NSO, LN
Lynx landscape linkage, denning and winter foraging habitat	TL	CSU	CSU	CSU
Lynx denning sites: No surface use is allowed during March 1–August 30 within 1 mile of known, active, den sites	TL	TL	TL	TL
Southwest willow flycatcher: No surface occupancy within 325 feet of ordinary high water mark in mapped habitat	NSO	NSO	NSO	NSO
Southwest willow flycatcher: No surface use is allowed during May 1–August 15 in suitable nesting habitat as mapped by the USFS, BLM, USFWS, or CPW	TL	TL	TL	TL
Gunnison sage-grouse	LN	LN	LN	LN
Gunnison sage-grouse proposed occupied critical habitat: Protecting priority habitat such as lek sites and nesting habitat	NSO 0.25 mile of lek sites	NSO	NAL	NSO
Gunnison sage-grouse proposed occupied critical habitat: The Field Manager may require the proponent/applicant to submit a plan of development (see Appendix H for full details)	SLT	CSU	NAL	CSU
Gunnison sage-grouse proposed unoccupied critical habitat: NSO would be allowed within a 0.6-mile radius of a newly identified lek site; TL may be applied to lease activities if surface occupancy is allowed (see Appendix H for full details)	SLT	CSU 0.6 mile of lek sites	NSO	CSU
Gunnison sage-grouse: Noise restriction in proposed occupied and unoccupied critical habitat (see Appendix H for full details)	SLT	CSU	CSU	CSU
Columbian sharp-tailed grouse lek site: NSO is allowed within a 0.4pmile buffer of a lek	SLT	NSO	NSO	SLT
Columbian sharp-tailed grouse: Noise restrictions	SLT	CSU	NSO	CSU
Columbian sharp-tailed grouse: TL may apply to construction, drilling, and workovers within 1.25 miles of an identified lek site from March 15 through July 30 (see Appendix H for full details)	TL	TL	NSO	TL
State wildlife areas: Bodo, Dan Noble, Dry Creek, Lone Cone, Lone Dome, Perins (and BLM lands to comprise HMA), Puett Reservoir, Williams Reservoir, Coalbed Canyon, Devil Creek, Fish Creek, Haviland, and Joe Moore	SLT	NSO	NAL	CSU
Migratory birds	LN	LN	LN	LN
Eagles, all accipiters, falcons, buteos, and owls: Within specified distance from nest and communal winter roost sites; see Appendix H, Table H-1: Raptor Conservation Measures	TL/NSO	NSO	NSO	NSO
Eagles, all accipiters, falcons, buteos, and owls: TL would be applied to all development activities; see Appendix H, Table H-1: Raptor Conservation Measures.	TL	TL	NSO	TL

Wildlife	Alt A	Alt B	Alt C	Alt D
Big game parturition: For pronghorn fawning areas (on SJNF and TRFO, includes the overall range for the species), May 1–July 1; for elk calving areas, May 15–June 30; for Rocky Mountain bighorn sheep lambing, April 15–June 30; for desert bighorn sheep lambing, February 1–May 1	TL	TL	NSO	SLT
Big game severe winter range, winter concentration and mule deer critical winter range, and production areas: CSU to provide for healthy ungulate populations	SLT	CSU	CSU	SLT
Big game winter range: No surface use is allowed during the following time period(s) in mapped severe winter range, winter concentration and mule deer critical winter range: pronghorn antelope, December 1–April 30; Rocky Mountain bighorn sheep, November 1–April 15; desert bighorn sheep, December 1–April 15; mule deer, December 1–April 30; elk, December 1–April 30	TL	TL	NSO	SLT
Gunnison prairie dog	SLT	CSU	CSU	SLT
Bats: NSO within a 0.25-mile radius of known maternity roosts or hibernacula of BLM and USFS sensitive bat species	SLT, LN	NSO, LN	NSO, LN	SLT, LN
CSU = Controlled surface use LN = Lease notice NAL = Not available for lease NSO = No surface use SLT = Standard lease terms TL = Timing limitation For additional information, see Appendix H in the LRMP.				

Strategies for protecting wildlife through use of lease terms would vary by alternative (see Volume III, Appendix H and Table 3.3.6). Standard lease terms are the least restrictive requirements that would be applied in the PLAA. Where areas are leased with standard lease terms (Form 3100-11) managers would exercise the terms' flexibility to require modifications to siting or facility design to minimize adverse impacts on significant wildlife resources, but the adjustment would be consistent with lease rights granted. Managers and operators do have responsibility to protect environmental resources under standard lease terms. It is the responsibility of the Authorized Officer to require all lease operation be conducted in a manner that protects other natural resources and the environmental quality (43 CFR 3161.2). The Authorized Officer will determine, based on environmental review, the appropriate terms and conditions of approval of the submitted plan (43 CFR 3162.5-1(a)). The operator shall conduct operations in a manner that protects the mineral resources, other natural resources, and environmental quality (43 CFR 3161.5-1 (a)). The BLM may apply mitigation measures not in the LRMP when supported by best available science and analyzed in a site-specific NEPA analysis.

CSU has more flexibility to address significant wildlife concerns than under the terms of the standard lease form. CSU allows relocating proposed operations beyond 200 meters (656 feet), and up to 0.5 mile to achieve the desired level of resource protection. CSU allows year-round occupancy and accessibility to leased lands while providing mitigation of effects on other resources.

TL stipulations are prescribed over much of the PLAA in areas available for oil and gas leasing. TLs are the predominant stipulations where use or occupancy of the land for fluid minerals exploration or development needs to be restricted during a specified period of the year. The scope of the TL stipulation could go beyond ground-disturbing activities to encompass any source of protracted or high-intensity disturbance that could interfere with normal wildlife behavior and negatively affect use of important wildlife habitats. The TL is not applied to the operation and maintenance of production facilities unless the analysis demonstrates a continued need for the mitigation and that less stringent measures would not be sufficient. The TLs are based on conservation strategies and the best available information to provide the protections necessary to maintain capability and effectiveness of important wildlife habitats. The TLs protect species during critical life stages, but do not account for potential loss of habitat capability or effectiveness outside the TL. TLs provide partial accessibility for a portion of the year and maintain the potential for extraction of oil and gas, but may increase costs due to timing constraints (such as a short operating season).

NSO stipulations require that surface occupancy not be allowed on all or a part of the leasehold. The NSOs are based on recovery plans, conservation strategies, conservation agreements, and the best available information to provide the protections necessary to maintain capability and effectiveness of important wildlife habitats. NSO stipulations are applied when the desired level of resource protection cannot be accomplished by less stringent stipulations, such as by relocating a proposed facility or activity within the lease area, or by avoiding activity during a specified period of time. Although use or occupancy of the land surface for fluid mineral exploration or development is prohibited, oil and gas under lands affected by NSO stipulations are available for extraction if extraction can be accomplished without occupying the surface (such as through directional drilling or draining the deposit from adjacent lands).

Lease notices are used to inform the leaseholder that a potential exists for additional survey, inventory, or other information need may exist prior to exercising lease rights. Lease notices notify the lessee about special items for consideration when planning operations, but do not impose new or additional restrictions beyond those already in the stipulations.

In addition to the types of lease stipulations described above, additional management standards and guidelines described in the LRMP would be applied to provide for wildlife habitat capability and effectiveness (see Volume II, LRMP, Section 2.3). In addition, guidance contained in agency manuals, handbooks, conservation strategies, and other referenced materials cited in the LRMP could be applied as COAs when individual wells are proposed to protect important wildlife habitats, features, and wildlife species. Additional referenced guidance listed in the LRMP includes threatened and endangered species recovery plans, wildlife-specific BLM and USFS manuals and handbooks (i.e., agency direction), and BMPs (e.g., BLM Gold Book). The BLM and USFS may apply mitigation measures not in the LRMP when supported by best available science and analyzed in a site-specific NEPA analysis.

Exceptions, modifications, and waivers are options available to most lease stipulations and, if granted, would be based on evaluation of site-specific conditions that may warrant change in the original lease terms. Exceptions are one-time exemptions from a stipulation, whereas modifications are changes to the provisions of the stipulation that are either temporary or for the term of the lease. A waiver is a permanent exemption to a stipulation. Granting an exception, modification, or waiver to a lease stipulation is limited to situations in which the Authorized Officer determines that 1) the factors that led to its inclusion in the lease have changed sufficiently to make it no longer justified or 2) granting would not cause unacceptable impacts to the resource protected by the stipulation.

In most cases, much (about 65%) of the development (new well pads, miles of new roads, and acres of new disturbance) within the PLAA is projected to occur on unleased lands (see Volume III, Appendix F). All alternatives, except the No Leasing Alternative, project some degree of expansion of oil and gas development impacts, and impacts from this expansion are likely to occur in wildlife habitats or areas that have been previously relatively unaffected by oil and gas development activities. For those areas already leased and/or developed, additional development is expected to increase the intensity and potentially also the duration of impacts to wildlife species and habitats. If additional development occurs in areas already affected by oil and gas operations, additional impacts to wildlife could be slight to moderate and represent only an incremental increase in the level and/or duration of impacts that already occur. If development occurs in areas not already affected by oil and gas operations, impacts to wildlife could be immediate and result in wildlife responses that range from low to moderate depending on the nature, extent, intensity and duration of development that was approved. In addition, wildlife responses to oil and gas development are expected to be site-specific and vary depending on species of wildlife affected, and modified (positively or negatively) by terrain and other physical and vegetation factors. The No Leasing Alternative would have the least additional impact to wildlife species and habitats, as compared to other LRMP alternatives. However, some development would occur on lands already leased, and therefore the No Leasing Alternative could also have additional impacts to wildlife habitat capability and/or effectiveness, although at a smaller scope and scale as compared to the four action alternatives. In the PLAA, 71.8% of the fluid mineral estate is managed by the BLM. The rest of the fluid mineral estate is private or state ownership. Existing leases make up 20.7% of the PLAA, and 28.7% of the fluid mineral estate is currently leased. Existing leases that have seen some level of development or are currently held by production make up 2.4% of the PLAA.

DIRECT AND INDIRECT EFFECTS

Wildlife habitats within the PLAA directly affected by projected development of new well pads, roads, pipelines, and compressors would represent a relatively small overall proportion of all habitats present on BLM and NFS lands in the PLAA. For example, the most impactive alternative, Alternative A, projects total acres of disturbance on leased and unleased lands from GSGP and conventional activities in the PLAA to be about 0.8% of all BLM and NFS lands within the PLAA. However, impacts of oil and gas development on wildlife would extend beyond direct loss of habitat. Construction and operation disturbances associated with oil and gas infrastructure (well pads, compressor stations, roads, and pipeline and utility corridors) would reduce habitat effectiveness for wildlife across a larger matrix of habitat within which development occurs. These disturbance areas would vary in size depending on a number of factors, including intervening terrain and vegetation, the type and duration of the disturbance factor, the species of wildlife affected by the disturbance factor, and the time of year the disturbance factor occurred in relation to important wildlife life history events.

Direct and indirect impacts to wildlife in the PLAA could be greatest during the construction phase and primarily related to human disturbance, direct habitat loss, and fragmentation of important wildlife habitats. Infrastructure construction impacts would be reduced by applying the lease stipulations described above, BMPs, and conservation procedures and LRMP standards and guidelines as COAs. The lease stipulations require avoidance of important habitats for some species and/or TLs that restrict development activities to occurring outside critical life history periods for certain wildlife species of concern.

Operational impacts causing disturbances to wildlife on important seasonal ranges are likely to be long term in nature (i.e., lifespan of the facility), but could be mitigated by TLs, reclamation requirements, modification of rate of leasing and development, clustering of activities and collocation

of infrastructure (such as roads, pipelines, and utility corridors), and road and traffic management requirement to include use of remote well monitoring telemetry to reduce traffic impacts. Remote well monitoring telemetry could effectively limit oil and gas well traffic associated with production to one to two visits per week, and thus reduce the potential impacts to wildlife habitat effectiveness.

Development as a result of fluid mineral leasing within the PLAA is likely to have some effects to wildlife habitats, but the extent, duration, and intensity of effects would vary depending on many site-specific development factors and would vary depending on species of wildlife affected and timing of development activities in relation to species' life history events. Mechanisms by which development could negatively affect populations, species, and important habitats include direct loss of important habitats and/or key habitat components, direct and indirect effects of expanded road networks, increased traffic on existing road networks, displacement of animals from preferred ranges that are presumably of higher quality to less preferred ranges that are presumably of lower quality, and the duration of time over which oil and gas infrastructure was in production prior to reclamation and restoration of pre-existing wildlife habitats. Application of lease stipulations, COAs, and LRMP standards and guidelines and other referenced guidance would likely reduce the intensity, scale, and duration of impacts on wildlife habitats, species, and individuals.

Fluid minerals leasing and development in the PLAA is likely to result in some degree of direct loss of habitat and/or key wildlife habitat components. Direct loss of habitat could reduce forage availability and other potentially important wildlife habitat components (such as large-diameter snags and roost trees) in the affected area. Direct loss of habitat would be a function of the number of wells and well pads, miles of roads, miles of utility corridors, and the number of other ancillary facilities constructed under each of the alternatives. Projected oil and gas development on NFS and BLM lands under the most impactive alternative (Alternative A) for leased and unleased lands could result in a direct loss of 6,640 acres of habitat within the PLAA from a projected 1,023 well pads and 517 miles of road (see Volume III, Appendix F). This represents slightly less than 1% of federal surface acres within the PLAA. Of these totals, approximately 65% of disturbance acres include well pads and roads projected to be on currently unleased lands in the PLAA. Federal minerals make up 71% (1,190,338 acres) of the 1,675,562 acres in the PLAA. Currently 29% of the federal mineral estate is leased (20.7% of the PLAA). There are 317 leases issued in the PLAA, and of those 32 leases have experienced some sort of development. Leases held by production make up 3% (39,718 acres) of existing leases and 97% of existing leases in the PLAA have not experienced any oil and gas development. Most of the current leased areas are undisturbed. Certain habitat types could be affected more than others by oil and gas leasing and development. However, for forested habitats, shrubland habitats, and alpine habitats, direct loss of habitat under the most impactive alternative (Alternative A) would not exceed 1% of available habitat for any habitat type across the planning area. Some habitat types, such as riparian and wetlands, are relatively limited on the landscape but are disproportionately important to wildlife. For this reason, leasing stipulations and LRMP standards and guidelines provide additional protection for these relatively less common habitat types. To partially offset long-term (life of production) impacts, non-productive well sites would be rehabilitated, and unused portions of producing well sites would be restored during the production phase. At the end of the production phase, all facilities would be removed and disturbed areas restored.

Indirect Effects of Travel Management: Increases in density of oil and gas access roads that are open to public motor vehicle use could occur in some portions of the PLAA under all alternatives, including the No Leasing Alternative due to development of already leased lands. Some of the development in the PLAA, however, could be achieved through utilization of existing road systems and construction of short spur roads to access new well locations and production infrastructure. Therefore, it is possible that development might result in only small increases in the extent of open

roads in the PLAA. In this case, the biggest impact of roads on wildlife might be through the indirect effects of increased traffic volumes and/or expanded traffic patterns on existing road networks and the resulting potential for increased disturbance and displacement effects to animals dependent on habitats in close proximity to existing road networks. The impact of roads on wildlife could be from direct habitat loss, the development of new roads passing through formerly more secure wildlife resting and feeding areas, and the potential for a wide variety of disturbance sources unrelated to oil and gas operations due to new road access facilitated by oil and gas activities in formerly unroaded areas. The increase in miles of road within wildlife habitat areas would likely accelerate over time as exploration identifies viable fields and as those fields areas are fully developed.

Duration of Impacts: The scale of development would likely influence the degree of impact fluid mineral operations would have on wildlife habitat capability and effectiveness. The impacts associated with oil and gas development within the PLAA are likely to be long term (exceeding the life of the LRMP, or multiple decades). Predicted timeframes for oil and gas development in the Paradox Basin are to complete drilling activities within 15 to 20 years. From the time of completion, wells may continue to produce for 30 years after that. Based on the assumption that on average within 30 to 35 years, half of all oil and gas wells and the majority of access roads would be removed and the areas reclaimed, oil and gas operational impacts to wildlife habitats would be expected to decline substantially within three to four decades after field development began. As year-round operational impacts decline and reclamation actions improve wildlife cover and forage opportunities, wildlife would be expected to begin returning to some former use patterns.

Alternative Comparison: The No Leasing Alternative would provide the greatest protection for in the PLAA, but some direct loss of habitats and indirect loss of habitat capability and effectiveness is likely under this alternative due to development of lands that have already been leased within the PLAA. The leasing alternatives that result in more ground-disturbing activities in the PLAA in or near primary habitats would carry greater potential for impacts to individuals and key habitat components.

Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA (Volume III, Appendix F), Alternative A has the greatest potential to negatively impact wildlife habitats. This is followed by Alternatives D, B, and C, respectively. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 19% difference in total combined acres of projected disturbance between the most impactive action alternative, Alternative A, and the least impactive action alternative, Alternative C. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 35% of the development within the PLAA that is projected to occur under the most impactive alternative, Alternative A. Total projected disturbance acres for areas already leased in the PLAA does not vary by alternative and would be about 38% of total projected disturbance.

Impacts to Species Groups

<u>Amphibians and Reptiles</u>

Oil and gas development could impact amphibians and reptiles through habitat fragmentation caused by facilities located in suitable habitats or direct mortality of individuals from vehicles during road crossings and from equipment during site construction/maintenance activities. Indirect loss of habitat capability and/or effectiveness is likely due to the potential for establishment of new populations of non-native invasive species plants or the expansion of existing plant populations. A variety of water and soil leasing stipulations (Volume III, Appendix H) would be applied at the leasing stage that would

provide protections for amphibian and reptile habitats. At the project development stage, LRMP standards and guidelines and other referenced guidance would be used, when necessary, to address oil and gas program activities that could impact amphibian and reptile habitats and/or populations. Implementing LRMP components (desired conditions, objectives, standards, guidelines, and other referenced guidance) to provide for sustainable ecological conditions across the SJNF and TRFO that are more similar to those found under HRV is expected to reduce potential impacts from oil and gas leasing and development activities on amphibian and reptile individuals and populations across the planning area during LRMP implementation.

Because many amphibians are associated with wetlands, perennial streams, water bodies, riparian areas, and fens, leasing stipulations and LRMP standards and guidelines and other referenced guidance that provide for the protection and maintenance of water-dependent features also provide habitat protections for many amphibian species. About 12 lease stipulations apply to water-dependent features and therefore provide some level of potential protection for amphibians associated with those features. Other referenced guidance, including the Watershed Conservation Practices Handbook (USFS 2006a), the Conservation Plan and Agreement for the Management and Recovery of the Southern Rocky Mountain Population of the Boreal Toad (Boreal Toad Recovery Team and Technical Advisory Group 2001), and rangeland standards and guidelines from Section 2.13 of the LRMP would be applied at the project level to address these site-specific concerns. Travel management standards and guidelines would also provide substantial protections for amphibians and their habitats during the development and operation of oil and gas infrastructure. With the application of the direction described above, impacts to amphibians from oil and gas leasing and development in the PLAA is anticipated to be small in scale and limited to impacts to small numbers of individuals. Population-level impacts to amphibians are not anticipated in the PLAA under even the most impactive LRMP alternative (Alternative A).

LRMP standards and guidelines and other referenced guidance that promote HRV conditions in sagebrush shrublands and semi-desert shrublands and grasslands would also provide for ecological conditions to which BLM sensitive reptile species are adapted, thereby promoting conservation of BLM sensitive reptile species. It is anticipated, however, that despite application of mitigation measures, some impacts to amphibians and reptiles is likely during development and operation of oil and gas facilities. It is also anticipated that impacts to reptiles and habitats for BLM sensitive reptiles are likely to be of relatively small scale with impacts limited to individuals in close proximity to oil and gas facilities. Based on the application of LRMP standards and guidelines and other referenced guidance, population-level impacts to reptiles are not anticipated from any alternative.

Because many amphibians are associated with wetlands, perennial streams, water bodies, riparian areas, and fens, leasing stipulations that provide for the protection and maintenance of water-dependent features also provide habitat protections for many amphibian species. In general, Alternative C applies lease stipulations that provide greater levels of protection for water-dependent features, compared to Alternatives A, D, and B. Alternative C provides for greater use of NSO stipulations, as compared to other alternatives that provide greater use of CSU and standard lease term stipulations, thereby providing comparatively less protection for water-dependent features than would occur under NSO stipulations. In addition, Alternatives A and D generally apply CSU and standard lease term stipulations across larger acreages than Alternative C, thereby applying lower levels of protections (compared to NSO stipulations) across larger areas, and thus providing reduced protection for water-dependent features as compared to Alternative C. Lease stipulations applied under Alternative B generally provide greater protections for water-dependent features than those applied under Alternatives A and D, but less than those under Alternative C.

Invertebrates

The potential impacts related to oil and gas leasing and development on the Nokomis fritillary butterfly are expected to be similar to those described previously for amphibians in relation to water-dependent features. Oil and gas leasing and development activities that may impact riparian areas, springs/seeps, and streamside zones are especially important because these areas provide habitat for the host plant and for the development of young and eggs. Lease stipulations (see Volume III, Appendix H and Table 3.3.6 above) that require NSO in riparian areas and LRMP standards and guidelines applied at the project development stage would minimize potential impacts to Nokomis butterfly individuals and populations. Invertebrates in general are found in all ecosystems across the SJNF and TRFO. They are diverse, widespread, and adapted to nearly all conditions that occur under HRV. Some invertebrate species are generalists and some are specialists. Implementing LRMP components (desired conditions, objectives, standards, guidelines, and other referenced guidance) to provide for sustainable ecological conditions across the SJNF and TRFO that are more similar to those found under HRV is expected to reduce potential impacts from oil and gas leasing and development activities on general invertebrate individuals and populations across the planning area during LRMP implementation.

Because Nokomis fritillary butterfly is dependent on host plants that grow in association with wetlands, perennial streams, water bodies, riparian areas, and fens, leasing stipulations that provide for the protection and maintenance of water-dependent features also provide habitat protections for this sensitive butterfly species. In general, Alternative C applies lease stipulations that provide greater levels of protection for water-dependent features, compared to Alternatives A, D, and B. Alternative C provides for greater use of NSO stipulations, as compared to other alternatives that provide greater use of CSU and standard lease term stipulations, thereby providing comparatively less protection for water-dependent features than would occur under NSO stipulations. In addition, Alternatives A and D generally apply CSU and standard lease term stipulations across larger acreages than Alternative C, thereby applying lower levels of protections (compared to NSO stipulations) across larger areas and thus providing reduced protection for water-dependent features as compared to Alternative C. Lease stipulations applied under Alternative B generally provide greater protections for water-dependent features than those applied under Alternatives A and D, but less than those under Alternative C.

Migratory Birds

Much of the anticipated oil and gas development in the PLAA is expected to be in lower-elevation habitat types, including pinyon-juniper, ponderosa pine, and warm-dry mixed conifer forests, and in sagebrush and mountain shrublands and desert grasslands. Lesser amounts of oil and gas development are expected in higher-elevation habitats such as spruce-fir, cool-moist mixed conifer, and aspen forests. For these reasons, bird species more closely associated with lower-elevation habitat types may be more likely to be negatively affected by oil and gas development in the PLAA than are bird species associated with higher-elevation habitats.

In general, the amount of habitat likely to be affected by oil and gas leasing and development during LRMP implementation under any of the LRMP alternatives is expected to be relatively small, when compared to the total amount of habitat currently available within the PLAA and across the SJNF and TRFO. For this reason, and for most migratory bird species, the impacts of direct habitat loss or alteration would be relatively small and likely not sufficient to result in population-level impacts or in changes to species distributions within the PLAA. However, for some bird species associated with less extensive habitats (e.g., riparian areas and wetlands) or uncommon habitats (e.g., mature cottonwood gallery forest), it is possible that LRMP implementation activities that affect that particular habitat or important structural attribute could have unexpectedly larger impacts to a specific bird

species in a localized area. For all these reasons, impacts to species would vary under all of the alternatives. Impacts from oil and gas leasing and development in the PLAA are likely to occur within nesting, migration, and wintering habitats (or some combination of all habitats) depending on bird species and season of occurrence. For every action carried out under any LRMP alternative, some bird species could benefit from habitat alterations and human activities, some bird species may not be impacted at all, and some bird species may be negatively impacted. The degree of impact to migratory birds would differ depending on factors such as primary habitat association, effect on key habitat components, habitat generalist or specialist, and season of species occurrence.

Cavity Nesters

In general, potential impacts to snag-dependent bird species may be limited primarily to those program areas that cause or facilitate, directly or indirectly, the loss of standing snags, especially those snags greater than about 16 inches dbh (Bull et al. 1997; Parks et al. 1997; Schultz 2001). Project standards and guidelines would protect and maintain standing snags, especially large-diameter snags (greater than about 16 inches dbh).

Oil and gas development is likely to reduce habitat capability for snag-dependent birds through loss of large-diameter snags for safety and operational reasons and through harvesting for personal use firewood where access roads create better access to standing snags, and impacts may be minor to moderate in intensity depending on habitat type, past management history, and extent of public access, both before and after project development. Siting of oil and gas infrastructure and facilities would be conducted attempting to protect and maintain as many large-diameter standing snags as possible. Implementation of LRMP standards and guidelines, such as those concerning snag retention, are designed to protect and maintain important habitat characteristics and are expected to generally sustain populations across the PLAA under all of the alternatives.

The No Leasing Alternative would provide the greatest protection for cavity-nesting birds in the PLAA, but some loss of large-diameter standing snags is likely under this alternative due to development of lands that have already been leased within the PLAA. Of the action alternatives, Alternative C would have the least potential for impacts to habitat components for snag-dependent birds, followed by Alternatives B, D, and A. This is based on the projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP natural gas within the PLAA, and therefore the relative potential for oil and gas activities to reduce the abundance or affect the distribution of snag habitats in and adjacent to production areas. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 19% difference in total combined acres of projected disturbance between all alternatives. Projected acres of development in areas already leased do not vary by alternative and would be about 38% of total projected development. Conversely, about 62% of projected development within the PLAA would be on unleased lands and represents new impacts to cavity-nesting birds.

Raptors

The potential impacts of oil and gas leasing and development in relation to raptors would be primarily associated with disturbance and/or habitat modification at or near nest sites or winter roost sites (see wildlife analysis issue above that discusses impacts related to raptor disturbance and habitat effectiveness). Habitat modification could involve substantial changes to forest structural characteristics in important hunting habitats, structural improvements within close proximity to historically used nests when alternative nest options are unavailable, the loss of large standing snags that project above the surrounding forest canopy (super-canopy trees) and along the forest edges

that provide favored hunting perches, or the loss of atypical mature trees that provide sites for support of large and bulky stick nests. Under all alternatives, standards and guidelines would protect and maintain where possible large-diameter snags, increase recruitment of replacement snags, improve hunting habitats by moving ecological conditions closer to those expected under HRV, and maintain and improve habitat conditions for the diversity of prey species that make up the diet of most raptor species (e.g., recommendations of Reynolds et al. 1992).

Many raptor species have documented sensitivities to energy development and other human activities (Fuller 2010; Smith et al. 2010). Proximity to disturbance source is an important characteristic of response by raptors, with raptor species and habituation playing a role in some situations (Smith et al. 2010). Raptor nesting areas tend to be used regularly and predictably, often for many successive years. For this reason, conservation of raptor populations is often approached through the application of timing restrictions and buffer distances around known historic nesting sites to prevent those sites from becoming unusable due to excessive disturbance during key nesting seasons. To increase the likelihood of successful productivity and maintenance of non-breeding roost sites of species with documented sensitivities to energy development, a leasing stipulation would provide for NSO within distances of 0.25 to 0.5 mile from nest and roost sites. Three oil and gas lease stipulations apply specifically to raptor habitats, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to raptor habitat components (see Volume III, Appendix H). The application of distance buffers and TL is species dependent, based on the best available information for the local area (see Volume III, Appendix H, Table H-2; CPW 2008; Romin and Muck 2002). These recommendations have been adopted by the SJNF and TRFO, with some minor changes due to local conditions and site-specific knowledge. With the application of standards and guidelines, impacts related to oil and gas leasing and development activities in the PLAA are expected to be limited in scope and small in scale, and therefore are not expected to cause detectible changes in raptor abundance or distribution across the PLAA.

The No Leasing Alternative would provide the greatest protection for raptors in the PLAA, but some loss of nest and roost trees and foraging perches is likely under this alternative due to development of lands that have already been leased within the PLAA. Of the action alternatives, Alternative C would have the least potential for impacts to raptor habitats, followed by Alternatives B, D, and A. This is based on the projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP natural gas within the PLAA, and therefore the relative potential for oil and gas activities to reduce the abundance or affect the distribution of raptor perches and potential nest and roost trees. It is also based on relative expected levels of disturbance associated with oil and gas operation activities in and adjacent to production areas. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 19% difference in total combined acres of projected disturbance between alternatives. Projected acres of development in areas already leased do not vary by alternative and would be about 38% of total projected development. Conversely, about 62% of projected development within the PLAA would be on unleased lands, representing new potential impacts to raptors.

Mammals

Mammals that occur in the PLAA include species from a wide variety of greatly differing groups such as furbearers and carnivores, big game and other game species, small to medium-sized mammals, and specialized mammal groups such as bats. Some mammal species, such as deer mouse and black bear, are generalist species that occur in a wide variety of habitats across the entire PLAA, while other mammal species, such as southern red-backed vole and American marten, are specialist

species associated primarily with a limited number of distinct habitat types and/or vegetative successional stages. Much of the anticipated oil and gas development in the PLAA is expected to be in lower-elevation habitat types, including pinyon-juniper, ponderosa pine, and warm-dry mixed conifer forests, and in sagebrush and mountain shrublands and desert grasslands. Lesser amounts of oil and gas development are expected in higher-elevation habitats such as spruce-fir, cool-moist mixed conifer, and aspen forests. For these reasons, mammal species more closely associated with lower-elevation habitat types may be more likely to be negatively affected by oil and gas development in the PLAA than are mammal species associated with higher-elevation habitats.

The vast differences in life history and habitat requirements among the wide variety of mammal species in the PLAA suggest that mammals are likely to be influenced in a variety of ways by oil and gas development, some negatively and some positively. In general, however, most negative effects to mammals from oil and gas development are likely to result from direct habitat loss, habitat fragmentation, displacement, and loss of habitat effectiveness. Lease stipulations, LRMP standards and guidelines, and other referenced guidance would be applied at the oil and gas leasing stage and at the development stage, and are expected to reduce potential negative impacts to most mammal species. Some wildlife lease stipulations would require avoidance of habitat or conditions on surface use. Other potential measures that could be applied during development and as conditions of approval include options such traffic limitations, obliteration of unused roads and facility construction areas, TL, road use restrictions, or noise restrictions.

Mammal species expected to be most impacted by oil and gas activities are those with relatively narrow tolerances to disturbance, species with restricted year-round or seasonal habitats, and/or species with habitats that are limited across the planning area. Impacts from oil and gas leasing and development to bats, a highly specialized mammal group, are expected to be similar to those described for cavity nesting birds above. One oil and gas lease stipulation applies specifically to bat habitats, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to bat habitats (see Volume III, Appendix H). Mammals such as deer, elk and bighorn sheep are examples of economically important species that could be negatively affected by some aspects of oil and gas leasing and development activities. The planning area contains abundant summer habitats. Deer and elk utilize linear topographic features (river valleys, mid-ridge, and ridge tops) as travel routes to transition between generally disjunct summer and winter ranges in the PLAA. Oil and gas development could impact traditional animal movement or migration routes (see wildlife issue above that analyzes physical fragmentation of key wildlife habitats). Oil and gas leasing and development could also reduce habitat capability and habitat effectiveness on migration pathways (see wildlife issue above that analyzes maintaining or improving habitat conditions and movement opportunities within wildlife travel corridors). Oil and gas leasing and development could also reduce capability and effectiveness of big game winter ranges (see wildlife issues above that analyze disturbance and big game habitat effectiveness). Effects could be primarily associated with disturbance on, and potential displacement from, important traditional use winter ranges. Displaced animals are likely to be moved into non-traditional winter areas that presumably would have lower habitat capability compared to their preferred traditional winter use areas, potentially resulting in reduced overwinter survivorship, reduced productivity, or increased overwinter mortality.

The indirect effects of displacement of animals from preferred ranges that are presumably of higher quality to less preferred ranges that are presumably of lower quality is likely to range from minimal to possibly substantial depending on the scale of development and habitat conditions. Additional environmental analysis will be completed when there is a proposal for full field development. Full field development could result in reduced capability and effectiveness of preferred important seasonal ranges such as severe winter range and winter concentration areas and production areas. Field

development could also increase highway mortality of animals that are displaced from preferred ranges. Individuals of a species could experience reduced body condition, a result of displacement to new ranges that have lower nutritional quality as compared to the ranges they were displaced from. Site-specific project design at the field development stage would address displacement with the goal of minimizing overall disruption of seasonal habitat use or migration corridors. Displacement during the production phase is expected to result in only a relatively small incremental alteration of habitat use and movement patterns for both individual animals and entire herds, because of anticipated habituation to regular low-grade disturbance (Yarmoloy et al. 1988) and the application of leasing stipulations and LRMP standards and guidelines that could close roads in some key winter ranges to public motorized use. Nevertheless, the additive and/or cumulative effects of displacement events within the PLAA on big game animals could become detrimental to individual animals' health or condition, particularly in areas where concentrated development overlaps with concentrated animal winter use areas. The effects of displacement on big game animals is likely to vary from year to year and depend on local weather conditions, habitat and topographic features, and on oil and gas field operational activity patterns.

A variety of leasing stipulations (see Volume III, Appendix H), LRMP standards and guidelines, and other referenced guidance are expected to reduce potential negative effects of oil and gas leasing and development on deer and elk and provide habitat conditions necessary to support CPW population objectives for big game herds on the SJNF and TRFO. Three oil and gas lease stipulations apply specifically to big game winter and parturition habitats, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to big game winter and parturition habitats (see Volume III, Appendix H). Some of this LRMP direction, such as leasing stipulations, is applied at the leasing stage, whereas other LRMP direction, such as standards and guidelines, is applied at the project development stage during LRMP implementation. LRMP direction is expected to provide the ecological conditions necessary to support big game populations widely distributed across the PLAA.

In the PLAA there are 929,152 acres of severe winter range, winter concentration, and parturition areas for elk, mule deer, and bighorn sheep. This is approximately 56% of the PLAA. Under Alternatives A, B, and D, 7%, 7% and 6% of big game sever winter range, winter concentration, and parturition areas are not available for leasing, respectively. Under Alternative C, 28% of the same ranges are not available for leasing. Leasing stipulations and plan standards and guidelines provide the necessary tools to mitigate impacts of any potential development. Development is required to ensure that it does not lead to declines in big game populations. Mitigation measures not identified in the LRMP can be incorporated into future projects if those mitigations are supported by best available science and are supported in a site-specific NEPA document.

In general, Alternative C applies lease stipulations that provide greater levels of protection for big game habitats as compared to Alternatives A, D, and B, respectively. Alternative C provides for greater use of NSO stipulations, as compared to other alternatives that provide greater use of CSU, TL, and standard lease term stipulations, thereby providing comparatively less protection for big game winter and parturition habitats than would occur under NSO stipulations. In addition, Alternatives A and D generally apply standard lease term and TL stipulations across larger acreages than Alternative C, thereby applying lower levels of protection (compared to NSO stipulations) across larger areas and thus providing reduced protection for big game winter and parturition habitats, as compared to Alternative C. Lease stipulations applied under Alternative B generally provide greater protections for big game winter and parturition habitats than those under Alternatives A and D, but less than those under Alternative C. Given the application of leasing stipulations and LRMP standards and guidelines that provide for big game habitat capability and effectiveness, big game habitat

conditions, including winter ranges and parturition areas, are expected to be sufficient to support CPW population objectives for herds within the PLAA.

Cumulative Effects

Table F.19 in Volume III, Appendix F projects anticipated development within the cumulative effects area, categorized by federal leases and by private and state leases. Oil and gas development of lands made available for lease or already leased is projected to continue over the life of the LRMP within the PLAA (see Appendix F). Total combined acres of disturbance on leased and unleased lands on the SJNF and TRFO for conventional and GSGP gas within the PLAA for the most impactive alternative, Alternative A, is projected to be about 6,640 acres (see Table F.18, Appendix F). Total acres of disturbance on private and state leases including other infrastructure requirements in the cumulative effects area (see Table F.19, Appendix F) are projected to potentially be more than 1.5 times that on federal leases in the PLAA. Together, total acres of disturbance on federal and private and state leases are projected to potentially exceed 18,000 acres. Therefore, within the cumulative effects analysis area, the total acres of disturbance are projected to potentially be about three times that of federal leases within the PLAA. For this reason, impacts to wildlife species and important wildlife habitats in the cumulative effects area could be substantially greater than those projected for federal leases alone. Much of the projected disturbance is expected to be in pinyon-juniper, ponderosa pine, and warm-dry mixed conifer forests, and in sagebrush and mountain shrublands and desert grasslands.

Projected miles of road on private and state leases in the cumulative effects area is slightly more than that projected for federal leases in the PLAA (see Tables F.15 and F.19, Appendix F), and thus total road miles in the cumulative effects area could be more than double that of federal leases. For this reason, impacts to wildlife species with demonstrated sensitivities to roads and traffic patterns or volume/timing patterns, such as big game animals on winter and production ranges and Gunnison sage-grouse, could be substantially greater in the cumulative effects area than that projected for federal leases. The number of well pads in the cumulative effects area on private and state leases is projected to be slightly larger than that on federal leases in the PLAA (see Tables F.9 and F.19, Appendix F), and thus total number of well pads in the cumulative effects area could be more than double that of federal leases. For wildlife movement corridors and security areas where there are concerns for impacts from habitat fragmentation and increased or expanded human activities that could degrade wildlife habitat effectiveness, impacts in the cumulative effects area could be substantially greater than that projected for federal leases.

The impacts resulting from development of existing leases to the species groups in the cumulative effects area would be similar to those described in the direct and indirect effects sections above. Impacts of concern would be similar to those already discussed and include loss of habitat, habitat fragmentation, loss of habitat effectiveness, displacement of individuals from preferred habitat areas of presumably higher quality to less preferred areas of presumably lower quality, and potential for increased wildlife displacement over a significantly larger area and across mixed jurisdictions. The combined effects to wildlife individuals and populations in some areas could be increased mortality, reduced survivorship, and reduced productivity.

Development of oil and gas existing leases in the PLAA would be intermingled with development of future leases. Impacts resulting from development of future leases would be minimized by implementing standards and guidelines, lease stipulations, and other referenced guidance discussed above. Application of standards and guidelines, leasing stipulations, and other referenced guidance is expected to reduce the intensity of impacts to wildlife species and habitats, potentially reduce the duration of impacts, reduce the scope and scale of potential impacts, and reduce the potential for loss

of habitat capability and habitat effectiveness. However, it is not likely that all potential impacts from oil and gas leasing and development on wildlife species habitats could be completely eliminated, and thus some cumulative impacts to wildlife species and habitats is likely to occur over the short and long term.

Oil and gas development that could occur on private minerals would contribute to adverse impacts to wildlife by broadening the area of potential impacts. LRMP direction applicable to wildlife species would not apply to private land/mineral estate development. Newly promulgated State of Colorado regulations require lessee consultation with CPW prior to an undertaking, and thus some potential wildlife impacts might be reduced through application of CPW guidance and BMPs. Nonetheless, private mineral development could contribute to expanded wildlife impacts such as habitat fragmentation and loss of habitat effectiveness, particularly for species such as elk, mule deer, and Gunnison sage-grouse.

Oil and gas development and operational limitations have been implemented to provide for maintenance of winter wildlife habitat effectiveness and in production areas, including but not limited to site-specific measures such as road closures, utilization of remote telemetry to monitor wells, gas and produced water pipelines, electrification of older facilities, and activity TL. The extent and intensity of cumulative impacts from oil and gas leasing and development on winter wildlife habitat effectiveness is expected to vary across the cumulative effects area, but at present, winter habitats are believed sufficient and suitable to support CPW population objectives for big game herds in the PLAA on the SJNF and TRFO.

The human population in Dolores, San Miguel, and Montezuma Counties is projected to increase by a moderate to high rate over the plan period. This trend in human growth may result in increased fragmentation and the loss of habitat on private lands that surround the PLAA. The trend of increasing human populations is likely to also result in increased demand for goods and services from public lands. This would place additional demands on public lands to also provide the necessary types of wildlife habitats, juxtaposition of habitats, and forage and security areas that are required by wildlife species to continue utilizing the planning area at their current population levels. The cumulative effects of this development could compound impacts such as habitat fragmentation and loss of habitat effectiveness on non-federal lands adjacent to the TRFO and SJNF, potentially displacing animals to nearby federal lands and thereby increasing management challenges on federal lands.

Threatened and Endangered Species

The review and conclusions regarding the effects of the LRMP alternatives on threatened and endangered terrestrial wildlife species are presented above in FEIS Section 3.3, and in Appendix J (USFS BA). The BLM BA and formal consultation under Sec. 7 ESA is ongoing as of the publication of this FEIS. The BLM BA will be published with the BLM ROD and will reconcile any changes needed based on the response from USFWS. The information presented here addresses oil and gas leasing and development impacts in the PLAA on federally listed terrestrial wildlife species on the SJNF and TRFO.

The four federally listed terrestrial wildlife species evaluated in the LRMP include Canada lynx (threatened), southwestern willow flycatcher (endangered), Mexican spotted owl (threatened), and Uncompahgre fritillary butterfly (endangered). LRMP management direction (desired conditions, objectives, standards, guidelines, and other referenced direction) that applies to threatened or endangered species, and to a species proposed for listing as endangered under the ESA, the Gunnison sage-grouse, and proposed critical habitat for the Gunnison sage-grouse, is listed in LRMP Section 2.3. Actions associated with implementation of the approved LRMP alternative, including oil

and gas leasing and development, may impact federally listed species and/or their habitats. With application of lease stipulations described in Volume III, Appendix H, LRMP standards and guidelines and other conservation measures described and referenced in LRMP Section 2.3 (and direction contained in recovery plans referenced in that section), all alternatives would provide for conservation of listed species across the planning area and meet agency obligations under Section 7 of the ESA. Oil and gas development undertaken during LRMP implementation would be analyzed at the site-specific project level, any necessary Section 7 consultation would be conducted, and appropriate conservation measures from the above referenced guidance would be applied to surface use plans of operation.

Canada Lynx

The LRMP incorporates, by reference, the LCAS (Ruediger et al. 2000) and the SRLA (USFS 2008b), all associated standards and guidelines, and stipulations for the development of fluid minerals. The LCAS is the primary guidance document for management of lynx habitats on BLM lands, and the SRLA is the primary guidance document for management of lynx habitats on SJNF lands. Ruggiero et al. (2000) provides scientific information supporting the LCAS and SRLA.

Lynx habitat in the southern Rocky Mountains is usually found in the subalpine and upper montane forest zones, typically between 8,000 and 12,000 feet in elevation. Canada lynx are known to occur on the SJNF and TRFO. All lynx habitat in the PLAA is on SJNF lands, but there is no lynx habitat on BLM lands in the PLAA. The PLAA contains about 20% of the lynx habitat in the planning area (SJNF and TRFO). Two lease stipulations apply specifically to lynx habitat, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to lynx habitat components (see Volume III, Appendix H). About 80% of the lynx habitat in the PLAA would be subject to lease stipulations (NSO, CSU, TL, or standard lease terms) that are intended to protect various resources. Oil and gas leasing and development in the PLAA could result in impacts to lynx such as direct habitat loss and potential for increased disturbance from dispersed recreation activity. The increase in dispersed recreation activity could result in additional snow compaction and competition with competitors (coyote, fox, mountain lion, etc.). With application of LRMP standards and guidelines, lease stipulations, and direction from other referenced guidance, the USFS BA (see Volume III, Appendix J) concluded that potential effects to lynx from mineral and energy developments are expected to be minimized.

Oil and gas development activities could have a slight impact on lynx habitat components in the PLAA because some activities could occur in lynx habitat (see wildlife analysis issue above that analyzes maintaining or improving landscape connectivity for Canada lynx). However, the scale of potential impacts to lynx habitat is expected to be small and localized. Under the most impactive alternative, Alternative A, total projected combined acres of disturbance on leased and unleased lands in the PLAA is small (less than 1%) compared to the total amount of lynx habitat SJNF-wide. About 80% of lynx habitat in the PLAA is subject to lease stipulations that are expected to reduce potential impacts to lynx habitats and individual animals. For these reasons, projected oil and gas leasing and development activities are not expected to substantially alter lynx habitat capability or effectiveness under any LRMP alternative.

The No Leasing Alternative would provide the greatest protection for lynx habitat in the PLAA, but some loss of lynx habitat could occur under this alternative due to development of lands that are already leased within the PLAA. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to impact lynx habitat. Under Alternative A, up to about 20% of lynx habitat would potentially be available for leasing. Based on total combined acres of disturbance, Alternative A is followed by

Alternatives D, B, and C, respectively, in potential for impacts to lynx habitats. Total projected disturbance acres and total amounts of lynx habitat potentially available for leasing are very similar for Alternatives A and D, with somewhat less disturbance and lease availability in lynx habitat projected for Alternative B, followed by substantially less disturbance and lease availability in lynx habitat for Alternative C. There is only about a 26% difference in total combined acres of projected disturbance between the most impactive alternative, Alternative A, and the least impactive alternative, Alternative C. The amount of Lynx habitat available for leasing is about 55% less under Alternative C than under Alternative A. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 17% of the development on NFS lands that is projected to occur under the most impactive alternative, Alternative A. Projected acres of development for areas already leased do not vary by alternative and would be about 19% of total projected development. Conversely, about 81% of projected development within the PLAA would be on unleased lands and thus represents new impacts to lynx and lynx habitats.

All of the leasing alternatives, for both leased and unleased lands, would be guided by the same LRMP management direction. LRMP direction found in the standards, guidelines, and other referenced guidance, including the SRLA and LCAS, emphasizes the maintenance of ecological conditions and natural disturbance regimes typical of spruce-fir and cool-moist mixed conifer forests under HRV. This LRMP direction is expected to maintain suitable habitat conditions for lynx well distributed across the planning area throughout LRMP implementation.

Summary: Oil and gas leasing and development in the PLAA is expected to be only a minor contributing factor to potential impacts to Canada lynx and/or lynx habitats. LRMP components and lease stipulations would be applied to leasing and development stages, contributing to the conservation of lynx habitats in the PLAA. After considering projected activities for all program areas and potential impacts to lynx during LRMP implementation, the USFS BA (see Volume III, Appendix J) concluded that LRMP implementation “may affect and is likely to adversely affect” Canada lynx and lynx habitat. The primary reason for an adverse effect determination is due to direct and indirect effects associated with vegetation management across the SJNF.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is considered to be a riparian obligate species that nests in riparian willows, buttonbush (*Cephalanthus occidentalis*), boxelder (*Acer negundo*), tamarisk, or other riparian associated shrub species. Southwestern willow flycatchers are not known to occur in the PLAA. In addition, there is no known southwestern willow flycatcher habitat on SJNF or TRFO lands in the PLAA. Within the PLAA, most lands within the Upper Colorado Recovery Unit for the southwestern willow flycatcher are on BLM lands. The only known occurrence of southwestern willow flycatcher in the planning area is a single location on SJNF lands on the Pagosa Ranger District that has been occupied intermittently for 10+ years by zero to four singing males (see the USFS BA, Volume III, Appendix J). Potential risk factors associated with the LRMP alternatives in relation to southwestern willow flycatcher or its habitat would primarily be limited to activities that may occur near, or influence, willow-riparian systems.

The LRMP incorporates by reference the Southwestern Willow Flycatcher Recovery Plan (USFWS 2002a). The LRMP also incorporates two letters of direction from the USFWS that modifies southwestern willow flycatcher habitat descriptions and inventory and survey requirements for the planning area based on unique local conditions (USFWS 2011c, 2012d). Two lease stipulations apply specifically to flycatchers and flycatcher habitats, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to the riparian habitats on which the species depend (see Volume III, Appendix H). The application of lease stipulations and LRMP

components that avoid oil and gas leasing and development in riparian areas would reduce direct loss of riparian willow habitats. The LRMP components would also minimize the potential for disturbance to occupied habitats by minimizing the indirect impacts of oil and gas development and operation activities that could occur within or adjacent to suitable habitats. Brood parasitism of southwestern willow flycatcher by brown-headed cowbirds (*Molothrus ater*) has not been documented in the planning area and is currently not considered a local management concern (see the USFS BA, Volume III, Appendix J).

Oil and gas leasing and development activities could have indirect impacts to southwestern willow flycatcher habitats in the PLAA, but direct loss of southwestern willow flycatcher habitat is unlikely given the wide variety of LRMP components providing strong direction for protection of riparian areas and wetland systems. Additionally, riparian and flood plains are protected with an NSO stipulation.If indirect impacts did occur to flycatcher habitats not previously known in the PLAA, the scale of impacts is expected to be very small and limited in scope and intensity. About 86% of potential flycatcher habitat on the SJNF is subject to lease stipulations that are expected to reduce potential impacts to southwestern willow flycatcher habitats and individuals. In addition, there is strong LRMP direction to protect riparian areas and wetlands during LRMP implementation and thus projected oil and gas leasing and development activities are not expected to substantially alter current flycatcher habitat capability or effectiveness under any LRMP alternative.

The No Leasing Alternative would provide the greatest protection for flycatcher habitat in the PLAA, but there is a very small potential that some loss of habitat could occur under this alternative due to development of lands that are already leased within the PLAA. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to directly or indirectly affect southwestern willow flycatcher habitat. This is followed by Alternatives D, B, and C, respectively. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C.

On BLM lands, there is only about a 16% difference in total combined acres of projected disturbance between the most impactive alternative, Alternative A, and the least impactive alternative, Alternative C. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 58% of the development on BLM lands that is projected to occur under the most impactive alternative, Alternative A. About 42% of projected development on BLM lands in the PLAA would be on unleased lands and thus would represent new potential impacts to southwestern willow flycatcher and its habitat.

Summary: Oil and gas leasing and development in the PLAA is expected to be only a minor contributing factor to potential direct and indirect impacts to flycatcher habitats. LRMP components, lease stipulations, and other referenced direction would be applied to leasing and development stages, contributing to the conservation of southwestern willow flycatcher habitat in the PLAA. After considering projected activities for all program areas and potential direct and indirect impacts to the species during LRMP implementation, the USFS BA concluded that LRMP implementation “may affect but is not likely to adversely affect” the southwestern willow flycatcher or its habitat. The BLM BA and formal consultation under Section 7 of the ESA is ongoing as of the publication of this FEIS. However, the same mitigation measures and LRMP components will be applied on BLM lands, so it is anticipated that the BA for southwestern willow flycatcher or its habitat would have the same determination as the USFS BA. These determinations were based on numerous conservation measures and standards and guidelines to protect, maintain, and improve willow carrs and other riparian and wetland systems.

Mexican Spotted Owl

The Mexican spotted owl occupies two types of habitats, mountains and canyons. Breeding owls in southwest Colorado utilize deep, steep-walled canyons with mature coniferous or deciduous trees. The TRFO contains canyon habitat, similar to occupied habitats in Utah, consisting of steep canyons with little or no tree cover and rock crevices that appear to provide the same or similar microclimate as dense multi-storied forests. Most habitat on the TRFO occurs in the Dolores River Canyon and major canyons associated with the Dolores River drainage. Habitat on the SJNF includes mature mixed conifer vegetation on slopes greater than 40%, with 40% to 70% and greater crown closure. Bottoms adjacent to these steep-slope habitats that also contain mature forest types may also provide Mexican spotted owl habitat. There are limited narrow, rocky canyons occurring on the SJNF. Most Mexican spotted owl habitat on the SJNF is located in protected areas, including Chimney Rock National Monument, CRAs, designated wilderness, the Piedra Area, and RNAs. These areas are not available for oil and gas leasing or development. Despite extensive surveys across the TRFO and SJNF, only four verified occurrences of Mexican spotted owl have been found, all of which have been juveniles (see the USFS BA, Volume III, Appendix J). All Mexican spotted owl detections have been in the lower elevations of the southeast portion of the SJNF within steep canyons containing mature mixed conifer forests. These detections may represent dispersing or migratory individuals. Surveys have not identified any nesting pairs or reproductive activity on the TRFO or SJNF. The closest known nesting is located south of the planning area in and around Mesa Verde National Park within larger canyons with mature mixed conifer vegetation. The occurrence of Mexican spotted owl individuals on the SJNF appears to be incidental and uncommon, and similar to other locations in Colorado, apparently suitable nesting habitat remains unoccupied.

The PLAA contains at least 43% of Mexican spotted owl habitat in the planning area (SJNF and TRFO). The LRMP incorporates by reference the Mexican Spotted Owl Recovery Plan (USFWS 2012c) and habitat management direction. One oil and gas lease stipulation applies specifically to Mexican spotted owl habitat, but a variety of lease stipulations designed to protect other resources would also provide substantive protection of Mexican spotted owl habitat components (see Appendix H). About 89% of Mexican spotted owl habitat in the PLAA would be subject to lease stipulations (NSO, CSU, TL, or standard lease terms) that are intended to protect various resources. Oil and gas leasing and development in the PLAA could result in impacts to Mexican spotted owl, such as small amounts of direct habitat loss and potential for increased disturbance within or adjacent to Mexican spotted owl habitat. With application of LRMP standards and guidelines, lease stipulations, and direction from other referenced guidance including the Mexican Spotted Owl Recovery Plan, the USFS BA (see Appendix J) concluded that potential effects to Mexican spotted owl from minerals and energy developments are expected to be minimal.

The No Leasing Alternative would provide the greatest protection for Mexican spotted owl habitat in the PLAA, but there is a very small potential that some loss of Mexican spotted owl foraging habitat could occur under the No Leasing Alternative due to development of lands that are already leased within the PLAA. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to directly or indirectly affect Mexican spotted owl habitat. Under Alternative A, up to about 43% of Mexican spotted owl habitat planning area-wide would be potentially available for leasing. Based on projected combined total acres of disturbance, Alternative A is followed by Alternatives D, B, and C, respectively, in potential for impacts to Mexican spotted owl habitats. Total projected disturbance acres and total amount of Mexican spotted owl habitat potentially available for leasing are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B but similar

amounts of Mexican spotted owl habitats available for lease, then substantially less disturbance and Mexican spotted owl habitat available for lease for Alternative C.

Within the PLAA, there is only about a 19% difference in total combined acres of projected disturbance between the most impactive alternative, Alternative A, and the least impactive alternative, Alternative C. The amount of Mexican spotted owl habitat available for lease is about 19% less under Alternative C than under alternative A. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 35% of the development that is projected to occur under the most impactive alternative, Alternative A. About 62% of projected development in the PLAA would be on unleased lands and thus would represent new potential impacts to Mexican spotted owl and its habitat.

Summary: Oil and gas leasing and development in the PLAA is expected to be only a minor contributing factor to potential direct and indirect impacts to Mexican spotted owl habitats. LRMP components, lease stipulations, and other referenced direction would be applied to leasing and development stages, contributing to the conservation of Mexican spotted owl habitats in the PLAA. After considering projected activities for all program areas and potential direct and indirect impacts to Mexican spotted owl and its habitat during LRMP implementation, the USFS BA concluded that LRMP implementation “may affect but is not likely to adversely affect” the Mexican spotted owl or its habitat. The BLM BA and formal consultation under Section 7 of the ESA is ongoing as of the publication of this FEIS. However, the same mitigation measures and LRMP components will be applied on BLM lands, so it is anticipated that the BA for Mexican spotted owl will have the same determination as the USFS BA. These determinations were based on concluding that, overall, the effects of management actions from LRMP implementation are expected to be minimal based on the level of potential activity occurring in owl habitats, and the application of numerous leasing stipulations, LRMP standards and guidelines, and management recommendations described in the Mexican Spotted Owl Recovery Plan (USFWS 2012c).

<u>Uncompahgre Fritillary Butterfly</u>

The Uncompahgre fritillary butterfly is restricted to higher-elevation (greater than about 12,500 feet) alpine habitats with the presence of snow willow. There is no known Uncompahgre fritillary butterfly habitat on BLM or NFS lands in the PLAA (USFS BA, Appendix J). The only known occurrence of Uncompahgre fritillary butterfly in the planning area is a single location on SJNF land on the Columbine Ranger District. Because there is no Uncompahgre fritillary butterfly habitat in the PLAA, oil and gas leasing and development in the PLAA would have no potential to affect the Uncompahgre fritillary butterfly or its habitat.

<u>Gunnison Sage-grouse</u>

The Gunnison sage-grouse has been a BLM and USFS sensitive species, but is now proposed for listing as endangered under the ESA (USFWS 2013c). The Gunnison sage-grouse was proposed for listing as endangered on January 11, 2013. Proposed occupied and unoccupied critical habitat has been designated throughout the range of Gunnison sage-grouse. There are two small Gunnison sage-grouse populations within portions of the PLAA. All known sage-grouse populations in the planning area and all but 48 acres of proposed critical sage-grouse habitat in the planning area occurs on the TRFO. The 48 acres of proposed critical sage-grouse habitat on the SJNF is not believed to be occupied by sage-grouse. This 48-acre parcel is considered very marginal sage-grouse habitat given its fragmented nature from other habitat, lack of sagebrush, and existing disturbances associated with use of an access road, adjacent gravel pit, and agricultural activities on adjacent private lands (see the USFS BA, Appendix J).

The LRMP incorporates by reference the Gunnison Sage-grouse Rangewide Conservation Plan (Gunnison Sage-Grouse Rangewide Steering Committee 2005). Five lease stipulations apply specifically to Gunnison sage-grouse and sage-grouse habitat, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to sage-grouse habitats (see Appendix H). The application of lease stipulations, LRMP components, and other referenced direction that avoid oil and gas leasing and development in sage-grouse breeding and wintering habitats would reduce direct loss of grouse habitats. LRMP components would also minimize the potential for disturbance to occupied habitats and minimize the indirect impacts of oil and gas development and operation activities that could occur within or adjacent to suitable habitats.

Development and human activity are known to have negative impacts on sage-grouse habitat, occupation, and successful reproduction within its complex of suitable habitat. Principal threats to Gunnison sage-grouse habitat include habitat loss, degradation, and fragmentation due to residential, exurban and commercial development, and associated infrastructure such as roads and power lines. Oil and gas production facilities and power poles may provide hunting perches and habitats for mammal and avian predators, thereby increasing sage-grouse predation. Overhead power lines may also present a collision risk for sage-grouse, thereby increasing sage-grouse mortality. Sage-grouse may avoid suitable habitat containing overhead power lines in an effort to reduce their exposure to predation. Holloran (2005:57) also states “[P]redatory species’ responses to gas field development could be responsible for decreased survival of males on leks situated near the edges of developing fields.”

Gunnison sage-grouse occurrence within the PLAA and the TRFO is limited to the Dry Creek Basin and Miramonte subpopulations of the San Miguel population, and the Dove Creek subpopulation of the Monticello-Dove Creek population. The majority of acres occupied by the San Miguel Basin population occur in the Dry Creek Basin subpopulation. However, the Dry Creek Basin contains some of the smallest individual sage-grouse numbers in the San Miguel population. In 2012, the entire San Miguel Basin population contained an estimated 172 individuals on nine leks. Even though 47 sage-grouse have been reintroduced into the Dry Creek Basin subpopulation since 2006, there has been no increase in sage-grouse numbers. The basin is well below the population levels required to maintain a population.

There are 214,193 acres of proposed critical habitat for Gunnison sage-grouse in the PLAA, of which about 96,485 acres are proposed occupied critical habitat and about 117,708 acres are proposed unoccupied critical habitat. All proposed occupied and unoccupied critical habitat for Gunnison sage-grouse on the TRFO would be subject to one or more lease stipulations. Fluid minerals development is expected to continue on already leased lands within the PLAA, but would be approved in conformance with standards and guidelines outlined in the LRMP. New wells and other infrastructure constructed under existing lease rights that are located within sagebrush communities could have the potential to cause additional loss of sage-grouse habitats. Most development in the Dove Creek population would occur on private minerals or existing leases. Federal oil and gas mineral estate in the Dove Creek population is 39% of the area. Approximately 93% of the federal oil and gas mineral estate is currently leased. In the San Miguel population 13% of the federal mineral estate is currently leased for oil and gas development. Unoccupied critical habitat is 35% federal minerals and almost 80% of the federal mineral oil and gas estate is leased (Table 3.3.7).

Table 3.3.7: Gunnison Sage-grouse Critical Habitat in the Paradox Leasing Analysis Area

Proposed Critical Habitat	Acres in PLAA	Acres of Federal Minerals	% of PLAA	Acres of Existing Leases	% of Federal Minerals Currently Leased in PLAA
Occupied San Miguel population	68,624	54,621	79.6%	7,393	13.5%
Occupied Dove Creek population	27,861	11,036	39.6%	10,271	93.1%
Unoccupied critical habitat	117,708	41,830	35.5%	33,432	79.9%

Avoidance of oil and gas facilities by sage-grouse could decrease habitat effectiveness. With application of LRMP standards and guidelines, lease stipulations, and direction from other referenced guidance including sage-grouse management direction, potential effects to Gunnison sage-grouse from oil and gas leasing and developments activities are expected to be minimized. Although much of the occupied critical habitat is leased, future development would have to comply with LRMP standards and guidelines for Gunnison sage-grouse.

The No Leasing Alternative would provide the greatest protection for sage-grouse habitats in the PLAA, but there is potential that some loss of Gunnison sage-grouse habitats could occur under the No Leasing Alternative due to development of lands that are already leased within the PLAA. Existing leases compromise 26% of occupied Gunnison sage-grouse habitat in the PLAA and 79% of unoccupied critical habitat. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to directly or indirectly affect sage-grouse habitats. This is followed by Alternatives D, B, and C, respectively. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. On BLM lands, there is only about a 16% difference in total combined acres of projected disturbance between the most impactive alternative, Alternative A, and the least impactive alternative, Alternative C. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 58% of the development on BLM lands that is projected to occur under the most impactive alternative, Alternative A.

Under Alternative A about 42% of projected development on BLM lands in the PLAA would be on unleased lands and thus would represent new potential impacts to Gunnison sage-grouse and sage-grouse habitat. Alternatives B and D require an NSO stipulation be applied to all new leases in occupied Gunnison sage-grouse critical habitat. This would require that future development occur on existing leases. Some development of new leases could occur from an existing lease. No new development would be allowed under Alternatives B and D on new leases due to the NSO stipulation. Federal minerals make up 79% of the Gunnison sage-grouse habitat in the San Miguel Basin subpopulation within the TRFO. However, only 13% of the federal mineral estate is currently leased. Under Alternatives B and D, oil and gas leasing in proposed occupied critical habitat is leased with an NSO stipulation on the lease, therefore limiting any development to existing leases or fee/fee estates. In occupied Gunnison sage-grouse habitat, development of existing leases would occur on leases concentrated on the western edge of the Dry Creek Basin for the San Miguel population and on split estate and federal surface within the Dove Creek population. Wells and other infrastructure located within sagebrush communities would result in direct loss of sage-grouse habitats. Sage-grouse avoidance of these facilities would increase indirect habitat loss and loss of habitat effectiveness.

Under Alternative C, occupied critical habitat in the San Miguel population would not be available for leasing. Lands in the Dove Creek population of occupied critical habitat are almost 80% leased. Unleased lands in occupied critical habitat in the Dove Creek population would be available for leasing with an NSO stipulation. Alternative C applies lease stipulations that provide greater levels of protection for Gunnison sage-grouse habitats, compared to Alternatives A, D, and B. Alternative C provides for greater use of NSO stipulations, as compared to other alternatives that provide greater use of CSU and standard lease term stipulations, thereby providing comparatively less protection for sage-grouse habitats than would occur under NSO stipulations. In addition, Alternatives A and D generally apply CSU and standard lease term stipulations across larger acreages than Alternative C, thereby applying lower levels of protections (compared to NSO stipulations) across larger areas, and thus providing reduced protection for sage-grouse habitats as compared to Alternative C. Lease stipulations applied under Alternative B generally provide similar protections for grouse habitats as those under Alternative D, but less than those under Alternative C.

Summary: Oil and gas leasing and development in the PLAA is expected to be a contributing factor to potential direct and indirect impacts to Gunnison sage-grouse and sage-grouse habitat. LRMP components (including applicable lease stipulations, design criteria, and other referenced direction) would be applied to leasing and development stages, contributing to the conservation of sage-grouse habitat in the PLAA. Although these conservation measures when implemented would reduce negative impacts to sage-grouse and its habitat, it is expected that LRMP implementation “may affect, and is likely to adversely affect” Gunnison sage-grouse. This determination was based on concluding that substantial protection is provided for Gunnison sage-grouse under the LRMP and the current/future utility of sage-grouse habitat would not be impaired. However, this does not completely eliminate potential adverse impacts from the development of valid existing lease rights or remove the potential for management discretion to approve exceptions to LRMP stipulations and sage-grouse management guidelines. These conservation measures are expected to reduce negative impacts to sage-grouse habitat; however, not all impacts can be completely mitigated. Further, it is expected that implementation of the LRMP “may affect and is likely to adversely affect” Gunnison sage-grouse proposed critical habitat. This determination was based on the conclusion that land use authorizations would not result in adverse modification of critical habitat, but impacts of permanent infrastructure associated with valid existing lease rights could reduce the capability of critical habitat to satisfy requirements essential to both the survival and recovery of the species, thereby diminishing the value of critical habitat.

<u>Wolverine</u>

Primary habitat for the wolverine is restricted to higher-elevation alpine and sub-alpine habitats that are often inaccessible and generally not areas where oil and gas development is likely to occur. Much of the wolverine habitat in the planning area is located within designated wilderness or WSAs and therefore not available for lease. Within the PLAA, all wolverine habitats are on lands managed by the SJNF. There is no wolverine habitat on BLM lands in the PLAA.

None of the LRMP alternatives are likely to jeopardize the continued existence of the wolverine because there is currently no wolverine population on the SJNF, the TRFO, or in the state of Colorado. In addition, the listing proposal stated that land management actions do not pose a threat to the wolverine DPS (USFWS 2013b). The USFS BA (see Appendix J) determined that because there is no wolverine population in the planning area, and because land management actions conducted under LRMP implementation, including oil and gas leasing and development in the PLAA, are not thought to jeopardize the continued existence of the wolverine, conferencing with the USFWS on the effects of LRMP implementation to wolverine is not required. Following listing of the species,

separate site- and project-specific consultation with USFWS would be undertaken as necessary for LRMP implementation during NEPA analysis processes if projects were proposed that had the potential to affect wolverine or wolverine habitat.

BLM and USFS Terrestrial Wildlife Sensitive Species

The review and conclusions regarding the effects of the LRMP alternatives on agency-designated terrestrial wildlife sensitive species are presented above in FEIS Section 3.3, and in Appendix T (USFS BA and BLM Sensitive Species Analysis). The information presented here addresses oil and gas leasing and development impacts in the PLAA on agency-designated terrestrial wildlife sensitive species on the SJNF and TRFO.

BLM and USFS terrestrial wildlife sensitive species for the planning area are listed above in Table 3.3.3. These include 12 mammals, 20 birds, three amphibians, two reptiles, and one insect species from the BLM Colorado and USFS Region 2 lists. LRMP management direction (desired conditions, objectives, standards, guidelines, and other referenced direction) that applies to sensitive species is listed in LRMP Section 2.3. Actions associated with implementation of the approved LRMP alternative, including oil and gas leasing and development, may impact sensitive species and/or their habitats. With application of lease stipulations described in Appendix H, LRMP standards and guidelines and other conservation measures described and referenced in LRMP Section 2.3, and direction contained in additional referenced guidance cited in LRMP Section 2.3, all alternatives would provide for sustainability of sensitive species across the planning area and meet agency obligations for conservation of designated sensitive species. Oil and gas development undertaken during LRMP implementation would be analyzed at the site-specific project level, potential impacts to designated sensitive species and/or their habitats would be analyzed, and appropriate conservation measures from the above referenced guidance would be applied to surface use plans of operation. Mitigation measures not identified in the LRMP may be applied when supported by best available science and analyzed in a site-specific NEPA document.

The wide variety of sensitive species, key habitat components upon which these species depend, and the variety of season of use and/or presence within the planning area, indicates that all LRMP alternatives are likely to result in beneficial, neutral, and adverse effects to some sensitive species. The degree of impact and range of effects would depend on the sensitive species affected, the scope and scale of the project, and many other factors. The degree and direction of impact would likely vary, depending on factors such as project type, application of standards and guidelines, the season of year projects are implemented, and general habitat type. LRMP alternatives, such as Alternative D, that emphasizes greater vegetation manipulation or ground-disturbing activities that occur in habitats for sensitive species could carry a greater risk of causing more intensive and more negative impacts to more sensitive species. Effective implementation of LRMP direction and other referenced guidance during project implementation is expected to minimize impacts to sensitive species regardless of the selected alternative. LRMP direction in the LRMP includes a wide variety of direction that promotes conservation of sensitive species such as direction related to forest structural stages and canopy cover, riparian and wetland area enhancement, snag and downed log retention, and TL close to key nesting and roosting areas.

Much of the anticipated oil and gas development in the PLAA is expected to be in lower-elevation habitat types, including pinyon-juniper, ponderosa pine, and warm-dry mixed conifer forests, and in sagebrush and mountain shrublands and desert grasslands. Lesser amounts of oil and gas development are expected in higher-elevation habitats such as spruce-fir, cool-moist mixed conifer, and aspen forests. For these reasons, sensitive species more closely associated with lower-elevation

habitat types may be more likely to be negatively affected by oil and gas development in the PLAA than are sensitive species associated with higher-elevation habitats.

In general, the amount of habitat likely to be affected by oil and gas leasing and development during LRMP implementation under any of the LRMP alternatives is expected to be relatively small, when compared to the total amount of habitat currently available within the PLAA and across the SJNF and TRFO. For this reason, and for most sensitive species, the impacts of direct habitat loss would be relatively small and likely not sufficient to result in population-level impacts or in changes to species distributions within the PLAA. However, for some sensitive species that are associated with relatively rare (e.g., riparian areas and wetlands) or unusual habitats (e.g., mature cottonwood gallery forest), it is possible that LRMP implementation activities that affect that particular rare or unusual habitat or important structural attribute could have locally more substantial impacts to a specific sensitive species. For all these reasons, impacts to species would vary under all of the alternatives. Impacts from oil and gas leasing and development in the PLAA are likely to occur within reproduction, migration and movement corridors, and wintering habitats (or some combination of all three) depending on the species and season of occurrence. For every action carried out under any LRMP alternative, some sensitive species could benefit from habitat changes, some may not be impacted at all, and some may be negatively impacted. The degree of impact to sensitive species would differ depending on factors such as primary habitat association, effect to key habitat components, habitat generalist or specialist, and season of species occurrence.For additional analysis of impacts to sensitive species and the habitats on which they depend, see Appendix T, USFS BA and BLM Sensitive Species Analysis.

Sensitive species that are expected to be most impacted by oil and gas activities are those with relatively narrow tolerances to disturbance, species with restricted year-round or seasonal habitats, and/or species with habitats that are limited across the planning area. Impacts from oil and gas leasing and development to bats, several of which are sensitive species that occur on the SJNF and TRFO, are expected to be similar to those described above. One oil and gas lease stipulation applies specifically to bat habitats, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to bat habitats (see Appendix H). The desert bighorn sheep is a BLM sensitive species that occurs in the PLAA and could be negatively affected by some aspects of oil and gas leasing and development activities (see wildlife issue above that analyzes physical fragmentation of key wildlife habitats, and issue above that analyzes disturbance and big game habitat effectiveness). Negative effects could be primarily associated with disturbance on, and potential displacement from, important traditional use winter ranges and parturition areas. Displaced animals are likely to be moved into non-traditional use areas that presumably would have lower habitat capability compared to their preferred traditional use areas, potentially resulting in reduced overwinter survivorship, reduced productivity, or increased mortality.

A variety of leasing stipulations (see Appendix H) and LRMP standards and guidelines and other referenced guidance are expected to reduce potential negative effects of oil and gas leasing and development on sensitive species and provide habitat conditions necessary to conserve sensitive species on the SJNF and TRFO. Nine oil and gas lease stipulations apply specifically to sensitive species habitats and conservation measures, but a variety of lease stipulations designed to protect other resources would also provide substantive protections to sensitive species and the habitats on which they depend (see Appendix H). Some of this LRMP direction, such as leasing stipulations, is applied at the leasing stage, whereas other LRMP direction, such as standards and guidelines, is applied at the project development stage during LRMP implementation. LRMP direction is expected to provide the ecological conditions necessary to support sensitive species populations widely distributed across the PLAA.

The No Lease Alternative would provide the greatest protection for sensitive species in the PLAA, but some loss of key habitat components is likely under this alternative due to development of lands that have already been leased within the PLAA. Of the action alternatives, Alternative C would have the least potential for impacts to sensitive species habitats, followed by Alternatives B, D, and A. This is based on the projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP natural gas within the PLAA, and therefore the relative potential for oil and gas activities to reduce the abundance or affect the distribution of key habitat components for sensitive species. It is also based on relative expected levels of disturbance associated with oil and gas operation activities in and adjacent to production areas. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 19% difference in total combined acres of projected disturbance between the most impactive alternative (Alternative A) and the least impactive action alternative (Alternative C). Projected acres of development in areas already leased do not vary by alternative and would be about 38% of total projected development. Conversely, about 62% of projected development within the PLAA would be on unleased lands and thus represents new potential impacts to habitats for sensitive species.

San Juan National Forest Management Indicator Species

Because the MIS concept and requirement does not apply to BLM lands or management actions, the following MIS discussions apply only to lands and actions carried out by the SJNF. Four species were selected as terrestrial wildlife MIS on the SJNF: Abert’s squirrel, American marten, elk, and hairy woodpecker. Due to their widespread distribution across the SJNF and the relative abundance of these four species on the SJNF, their viability across the planning area (SJNF) is not of concern. Also due to their widespread distribution and abundance, their viability across the planning area (SJNF) would not be threatened under any of the LRMP alternatives.

In general, the MIS analysis uses wildlife populations and habitat associations as the primary indicator of MIS trends. There are a variety of acceptable data sources for monitoring populations and habitat trends of MIS, including population estimates by state wildlife agencies, informed judgment of the USFS Wildlife Biologist, habitat inventory assessments, resource information system, and activity/program reviews. Population and habitat trends are estimated on an SJNF basis and are not specific to the PLAA, which is a subset of overall habitats for the terrestrial MIS.

<u>Abert’s Squirrel</u>

Abert’s squirrel is considered well distributed throughout the SJNF planning area in suitable ponderosa pine habitat. Habitat analysis shows the 20-year trend for suitable Abert’s squirrel habitat is stable, with a slight downward trend in optimal habitat. Population trends for the planning area are not thought to differ from the habitat trends, being generally stable. The identified risk factors for Abert’s squirrel’s selected monitoring issues involve management activities that change overstory forest structure of ponderosa pine forests and understory conditions for fleshy fungi that form mycorrhizal associations with pine roots.

It is estimated that about 114,600 acres of Abert’s squirrel habitat occurs in the PLAA, and this comprises about 50% of squirrel habitat SJNF-wide. A portion of oil and gas development projected to occur in the PLAA would occur within habitat suitable for Abert’s squirrel, but squirrel habitat is well represented and widely distributed across the PLAA. Oil and gas leasing and development activities in the PLAA is likely to affect Abert’s squirrel habitat structure and food sources under each of the leasing alternatives. Impacts would result from removal of large-diameter overstory ponderosa pine trees and surface vegetation that provides suitable conditions for fleshy fungi, due to road and facility

infrastructure construction and facility operations. Overall, however, total projected combined acres of disturbance on leased and unleased lands in the PLAA is small (less than 2%) compared to the total amount of Abert's squirrel habitat available SJNF-wide.

The No Leasing Alternative would provide the greatest protection for Abert's squirrel habitat on NFS lands in the PLAA, but some loss of squirrel habitat is likely under this alternative due to development of lands that have already been leased within the PLAA. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to negatively affect squirrel habitat. This is followed by Alternatives D, B, and C, respectively. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 26% difference in total combined acres of projected disturbance between the most impactive action alternative, Alternative A, and the least impactive alternative, Alternative C. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 17% of the development on NFS lands that is projected to occur under the most impactive alternative, Alternative A. Projected acres of development on NFS lands for areas already leased do not vary by alternative and would be about 19% of total projected development. Conversely, about 81% of projected development on NFS lands within the PLAA would be on unleased lands and thus represents new impacts to Abert's squirrel habitat and individuals.

All of the leasing alternatives, for both leased and unleased lands, would be guided by the same LRMP management direction. LRMP direction found in the standards, guidelines, and other referenced guidance addresses the maintenance and restoration of ecological conditions and natural disturbance regimes that more closely resemble those of HRV for ponderosa pine and warm-dry mixed conifer forests. This LRMP direction is expected to maintain and improve habitat conditions for Abert's squirrel, and thus squirrel populations are expected to remain well-distributed across the planning area during LRMP implementation.

<u>American Marten</u>

American marten are considered well distributed and relatively abundant in suitable habitats throughout the planning area. Habitat trends across the SJNF are considered stable, with stable to slightly upward population trends (SJNF American Marten Species Assessment [USFS 1991a]). Suitable habitat on the SJNF for American marten includes the spruce-fir and cool-moist mixed conifer cover types. It is estimated that about 128,750 acres of marten habitat occurs in the PLAA, and this comprises about 21% of marten habitat SJNF-wide.

The identified risk factors for the American marten's selected monitoring issues involve management activities that change forest structure within spruce-fir and cool-moist mixed conifer forests. Most oil and gas leasing and development activities in the PLAA are expected to occur at lower elevations not suitable for the American marten. Therefore, oil and gas leasing and development activities are not expected to have measurable effects on the American marten's currently stable to slightly upward habitat and population trends across the SJNF. Under all LRMP alternatives, overall habitat and population trends are expected to remain stable, or to slightly increase, across the planning area. Oil and gas leasing and development activities within the PLAA could slightly reduce the availability of marten habitat in the PLAA because some activities could occur in marten habitat. However, the scale of impacts to marten habitat is likely to be small and localized. Under the most impactive alternative, Alternative A, total projected combined acres of disturbance on leased and unleased lands in the PLAA is very small (less than 1%) compared to the total amount of marten habitat available SJNF-wide. For these reasons, projected oil and gas leasing and development activities are

not expected to cause detectible changes to SJNF-wide marten population or habitat trends under any LRMP alternative.

The No Leasing Alternative would provide the greatest protection for American marten habitat on NFS lands in the PLAA, but some loss of marten habitat is likely under this alternative due to development of lands that have already been leased within the PLAA. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to negatively impact marten habitat. This is followed by Alternatives D, B, and C, respectively. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 26% difference in total combined acres of projected disturbance between the most impactive alternative, Alternative A, and the least impactive alternative, Alternative C. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 17% of the development on NFS lands that is projected to occur under the most alternative, Alternative A. Projected acres of development on NFS lands for areas already leased does not vary by alternative and would be about 19% of total projected development. Conversely, about 81% of projected development on NFS lands within the PLAA would be on unleased lands and thus represents new impacts to marten habitat and individuals.

All of the leasing alternatives, for both leased and unleased lands, would be guided by the same LRMP management direction. LRMP direction found in the standards, guidelines, and other referenced guidance emphasizes the maintenance of ecological conditions and natural disturbance regimes typical of spruce-fir and cool-moist mixed conifer forests under HRV. This LRMP direction is expected to maintain suitable habitat conditions for American marten, and thus marten populations are expected to remain well distributed across the planning area during LRMP implementation.

Elk

Elk are a generalist species that occur in a wide variety of habitat types across the SJNF planning area. They are considered well distributed throughout the planning area within suitable habitats, and suitable habitats for elk vary by season. Habitat analysis shows the 20-year trend for summer range is stable, with an upward trend on winter ranges (SJNF Elk Species Assessment [USFS 2004b]). Populations have increased from the lows experienced during the 1980s. Currently, the elk population is considered stable (USFS 2004b). Elk populations are thought to be primarily influenced by the hunter harvest based on population objectives established by CPW. At present, habitat capability or effectiveness is not thought to be controlling elk populations for herds on the SJNF (USFS 2004b).

It is estimated that about 593,200 acres of elk summer and winter habitats occur in the PLAA, and this comprises about 29% of elk summer and winter habitats SJNF-wide. The PLAA represents about 28% of SJNF-wide elk cover habitats and 31% of forage habitats, respectively. On all elk summer and winter ranges SJNF-wide, the ratio of elk forage habitats to elk cover habitat is 42:58, which is somewhat different from the suggested optimum ratio of 60:40 to cover habitat (USFS 2004b). Within the PLAA, however, the elk forage:cover ratio is 45:55, indicating the PLAA may be somewhat more limited on forage habitats as compared to the suggested optimum ratio and the ratio SJNF-wide. The habitat feature that is considered most limiting to elk on the SJNF is winter range. Winter range as mapped by CPW comprises about 23% of elk habitats SJNF-wide. Within the PLAA there is about 223,300 acres of elk winter range, as mapped by CPW. This represents about 47% of elk winter range SJNF-wide. The forage:cover ratio on elk winter range is 61:39, very near the optimum ratio of 60:40. The SJNF-wide forage:cover ratio on elk summer range is 36:64, which is the inverse of the optimum ratio of 60:40.

On the SJNF, elk have ample summer range (about 1,571,600 acres) that provides forage, thermal and hiding cover, and calving grounds. During the winter months, elk become concentrated on a more limited area of winter ranges (about 471,200 acres) that overlap a variety of management activities and that are increasingly being influenced by human development pressures and uses adjacent to SJNF lands. Consequently, the general risk factors identified for elk as an MIS are primarily tied to activities and influences associated with low-elevation habitats, including pinyon-juniper, ponderosa pine, and warm-dry mixed conifer forests, and sagebrush shrublands and mountain shrublands. These low-elevation habitats are where most oil and gas leasing and development activities are anticipated on the SJNF and within the PLAA over the life of the LRMP. In addition, calving grounds and migration corridors also occur within areas of potential fluid minerals leasing and development. Oil and gas development could impact traditional animal movement or migration routes (see wildlife issue above that analyzes physical fragmentation of key wildlife habitats, and also see wildlife issue above that analyzes maintaining or improving habitat conditions and movement opportunities within wildlife travel corridors). Oil and gas leasing and development could also reduce capability and effectiveness of big game winter ranges (see wildlife issues above that analyze disturbance and big game habitat effectiveness, and improving the amount and condition of sagebrush shrubland habitats).

A variety of leasing stipulations (see Appendix H), LRMP standards and guidelines, and other referenced guidance are expected to provide habitat conditions necessary to support sustainable populations of big game ungulate species SJNF-wide, including elk. Some of this LRMP direction, such as leasing stipulations, is applied at the leasing stage, whereas other LRMP direction, such as standards and guidelines, is applied at the project development stage during LRMP implementation. LRMP direction is expected to provide the ecological conditions necessary to support big game populations, including elk, widely distributed across the SJNF and capable of meeting CPW population objectives.

The No Leasing Alternative would provide the greatest protection for elk habitat on NFS lands in the PLAA, but some loss of elk habitat is likely under this alternative due to development of lands that have already been leased within the PLAA. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to negatively impact elk habitats, including winter range. This is followed by Alternatives D, B, and C, respectively. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 26% difference in total combined acres of projected disturbance between the most impactive alternative, Alternative A, and the least impactive alternative, Alternative C. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 17% of the development on NFS lands that is projected to occur under the most impactive alternative, Alternative A. Projected acres of development on NFS lands for areas already leased does not vary by alternative and would be about 19% of total projected development. Conversely, about 81% of projected development on NFS lands within the PLAA would be on unleased lands and thus represents new impacts to elk habitat, including winter range. Given the application of leasing stipulations and LRMP standards and guidelines that provide for big game habitat capability and effectiveness, no change is expected to the currently stable overall population and habitat trends for elk SJNF-wide.

Hairy Woodpecker

Hairy woodpecker is considered well distributed and relatively abundant throughout the planning area within a wide variety of habitat types. The species is a primary cavity excavator, showing a preference

for aspen stands. Current information (USFS 2004c) suggests that hairy woodpecker populations have increased slightly in Colorado, as well as throughout their entire range. Recent habitat modeling and density estimate evaluations suggest that hairy woodpecker population and habitat trends on the SJNF are stable or slightly increasing (USFS 2004c). It is estimated that about 350,500 acres of hairy woodpecker habitats occur in the PLAA, and this comprises about 31% of hairy woodpecker habitats SJNF-wide.

The identified risk factors for the hairy woodpecker's selected monitoring issues involve management activities that change forest structure within aspen, ponderosa pine, and mixed conifer forests. Oil and gas leasing and development in the PLAA is not expected to substantially alter hairy woodpecker habitat or population trends across the PLAA or across the planning area. Activities that could influence hairy woodpecker populations and habitat trends in aspen, ponderosa pine, and mixed conifer forests include timber management, fire and fuels treatment activities, and livestock grazing as described in the general MIS section above. Oil and gas leasing and development activities within the PLAA are likely to reduce the availability of nesting and foraging sites for some individuals through the loss of large-diameter standing snags and live trees with heartwood decay near production infrastructure. However, the scale of these losses is likely to be small and localized and limited to relatively small numbers of suitable snags and live trees with heartwood decay. Under the most impactive alternative, Alternative A, total projected combined acres of disturbance on leased and unleased lands in the PLAA is very small (less than 0.5%) compared to the total amount of hairy woodpecker habitats available SJNF-wide. Consequently, projected oil and gas leasing and development activities are not expected to cause detectible changes to SJNF-wide population or habitat trends for the hairy woodpecker under any LRMP alternative.

The No Leasing Alternative would provide the greatest protection for hairy woodpecker key habitat components on NFS lands in the PLAA, but some loss of woodpecker habitat components is likely under this alternative due to development of lands that have already been leased within the PLAA. Based on projected total combined acres of disturbance on leased and unleased lands for conventional and GSGP gas within the PLAA, Alternative A has the greatest potential to negatively impact hairy woodpecker nesting and foraging habitats. This is followed by Alternatives D, B, and C, respectively. Total projected disturbance acres are very similar for Alternatives A and D, with somewhat less disturbance projected for Alternative B, followed by substantially less disturbance for Alternative C. There is only about a 26% difference in total combined acres of projected disturbance between the most impactive alternative, Alternative A, and the least impactive action alternative, Alternative C. The No Leasing Alternative would have the least amount of projected total disturbance acres, but still projects about 17% of the development on NFS lands that is projected to occur under the most impactive alternative, Alternative A. Projected acres of development on NFS lands for areas already leased does not vary by alternative and would be about 19% of total projected development. Conversely, about 81% of projected development on NFS lands within the PLAA would be on unleased lands and thus represents new impacts to hairy woodpecker habitats and individuals.

All of the leasing alternatives, for both leased and unleased lands, would be guided by the same LRMP management direction. LRMP direction addresses the maintenance of suitable nesting trees (large-diameter standing snags and live trees with heartwood decay) and other ecological needs of primary cavity excavators and obligate secondary cavity-nesting species found in the standards, guidelines, and other referenced guidance. This LRMP direction is designed to maintain suitable habitat conditions and thus populations of primary cavity excavator species such as hairy woodpecker, and thus hairy woodpecker populations are expected to remain well distributed across the planning area during LRMP implementation.

Cumulative Effects

Cumulative effects for MIS from oil and gas leasing and development activities in the PLAA would be the same as described above for MIS for LRMP implementation.

3.4 Riparian Areas and Wetland Ecosystems

3.4.1 Introduction

Riparian area and wetland ecosystems in the SJNF and TRFO occur on valley floors and other low-lying landscape positions where the water table is usually at or near the land surface (Cowardin et al. 1979). These ecosystems consist of a general type and four physiognomic types that include evergreen riparian forests, deciduous riparian forests, deciduous riparian shrublands, riparian areas, and wetland herbaceous lands (which includes fens and hanging gardens). The BLM defines a riparian area as “an area seasonally saturated or inundated at a frequency and duration sufficient to produce vegetation typically adapted for life in saturated soil conditions. It is also the transitional area between permanently saturated wetlands and upland areas often referred to as a riparian area” (Technical Reference 1737-16, BLM 2003a). Ecological processes and disturbances including fire, drought, wind, floods, flow regimes, and succession play a fundamental role in shaping the composition, structure, and function of riparian area and wetland ecosystems at multiple scales and in creating a heterogeneous pattern of vegetation communities across the planning area. The distribution of riparian area and wetland ecosystems in response to changing climatic conditions is determined by resulting changes in disturbance regimes and other global change factors (Turner 2010).

Riparian area and wetland ecosystems are important because they store water, enhance water quality, provide habitat for wildlife and plants, and provide recreation and esthetic values. Although they are small in extent (it is estimated they comprise less than 5% of the SJNF and TRFO planning area), they represent a very important ecological component of the SJNF and TRFO. For example, approximately half of the special status plant species found on the SJNF and TRFO are associated with riparian area and wetland ecosystems. These ecosystems are also recognized as an important component of the sustainable ecosystems strategy on the SJNF and TRFO.

Managing for sustainable riparian area and wetland ecosystems would protect and sustain diversity and the majority of species within them. However, in some cases a complementary plant species strategy may be needed for some species that are not adequately protected by a sustainable ecosystems strategy. For example, the special status plant species that occur in riparian area and wetland ecosystems have additional protection strategies that are described in detail in the terrestrial ecosystems section of the FEIS and LRMP. A complete list of special status plant species associated with riparian and wetland areas can be found in Appendix P.

3.4.2 Existing Conditions

Riparian and wetland areas are among the most productive ecosystems in the arid West. As a consequence, they have been the focus of concentrated use and human management for their water supply, forage, fish, wildlife, recreation, timber, minerals and other values throughout history. These historic uses have often resulted in long-term and significant changes to the floodplains, hydrology, native plants, and animals associated with them (Blair et al. 1996; Dahms and Geils 1997; Fleischner 1994; Prichard 1998; Rood and Mahoney 1990).

On the SJNF and TRFO, the degree to which historic use and land management practices have affected riparian area and wetland ecosystems varies depending on the type of riparian or wetland area and its location on the landscape. As a general rule, arid, low to mid elevation areas of the SJNF and TRFO have the fewest acres of riparian area and wetland ecosystems, and impacts to these ecosystems tend to be common. This is because lush vegetation and water supply are scarce across these landscapes except near riparian and wetland areas. They have always been attractive places to concentrate human and livestock/wildlife uses. Low-elevation federal lands tend to be closer to private lands, and the density of water development projects affecting water supply is greater (Colorado Division of Water Resources 2012). Invasive hydrophytic plant species that displace native riparian area and wetland ecosystem vegetation, such as tamarisk and Russian olive (Elaeagnus angustifolia), are common below 6,500 feet in elevation in southwest Colorado (Colorado Department of Natural Resources 2004). As a result, impacts to riparian area and wetland ecosystems from humans, livestock, and invasive species are most common on arid, low to mid elevation lands of the SJNF and TRFO.

In contrast, higher-elevation forested areas tend to have more acres of riparian area and wetland ecosystems, and in general these ecosystems are typically less impacted. Livestock and wildlife grazing/browsing is not typically concentrated in riparian area and wetland ecosystems because precipitation is high and supports forage in higher-elevation forested areas more evenly distributed across the landscape. These areas generally have fewer human water developments/diversions compared to low-elevation areas and are outside the range of tamarisk, Russian olive, and many other non-native invasive plants.

Adverse impacts commonly associated with riparian area and wetland ecosystems include decreased water flows, lower water tables, decreased flood frequency, and a decrease in the abundance and distribution of native hydrophytic plants (Blair et al. 1996; Dahms and Geils 1997; Fleischner 1994; Rood and Mahoney 1990). There are several causal factors that typically contribute to these impacts on the SJNF and TRFO, including 1) water developments that disrupt or significantly decrease water availability, 2) improper land management that triggers erosion and/or gullying leading to a loss of functional floodplains or wetland areas, 3) invasive hydrophytic plant species and other non-native species, and 4) improper or unmanaged livestock grazing in riparian area and wetland ecosystems. Many of these impacts are amplified during periods of warm drought.

Common problems with riparian area and wetland ecosystem plant species composition on the SJNF and TRFO include the lack of willows and cottonwood trees in deciduous riparian forests, late seral willows in deciduous riparian shrublands, and sedges and rushes in riparian area and wetland herbaceous types. Kentucky bluegrass, an exotic invasive grass, has replaced native sedges and rushes in many riparian area and wetland ecosystems. Tamarisk is found in many riparian area and wetland ecosystems where it competes with native cottonwoods and willows. Riparian area and wetland ecosystems have soils that classify as Mollisols or Entisols and soils that are somewhat poorly to very poorly drained and often high in rock content. Unique and rare riparian area and wetland ecosystem soils on the SJNF and TRFO include organic soils (Histosols). These soils are associated with peatland fens. Currently, soil productivity is intact in the riparian area and wetland ecosystems on most SJNF and TRFO lands, and most of the soils-related riparian area and wetland ecosystem desired conditions are being met.

Ecological conditions within riparian area and wetland ecosystems have improved to varying degrees on the SJNF and TRFO over the last 20 years. This is largely due to management direction from the BLM and USFS that has focused on riparian and wetland areas. In the early 1990s, as part of the Rangeland Reform policy, the BLM developed management strategies that emphasized the inventory

of riparian and wetland function and improvement of riparian area and wetland ecosystems where proper function was jeopardized or did not exist. Adoption of the BLM Colorado’s Standards for Public Land Health and associated livestock grazing guidelines in 1997 further emphasized improved riparian area management. Stipulations protective of riparian and wetland areas are applied to all oil and gas leases sold since 1991 (after the San Juan National Forest Land and Resource Management Plan was amended and stipulated) on BLM lands. The SJNF emphasized riparian area and wetland ecosystem management and protection through the 1983 and 1985 LRMP updates. Policy from the Rocky Mountain Region of the USFS also directed the use of special management and protective measures in wetlands and riparian areas (FSH 2509.25-2006-1). These federal policies improved how the USFS and BLM manage livestock grazing, road construction, recreation, timber harvest, oil and gas development, and other management practices to the benefit of riparian area and wetland ecosystems. However, many riparian area and wetland ecosystems on the SJNF and TRFO, especially those located in arid/semiarid climate and in low to mid elevation areas, are not in proper functioning condition and persist in a degraded condition. The most common remaining threats to riparian area and wetland ecosystems are improper grazing practices, water use development, invasive species, and prolonged warm drought.

3.4.3 Environmental Consequences

Management activities such as timber harvest, mechanical fuels treatments, oil and gas development, livestock grazing, recreation, prescribed fire, and minerals development would occur on the SJNF and TRFO within the next 15 years. Some of these activities may affect riparian area and wetland ecosystems. Impacts would depend on the size, timing, frequency, and duration of the activity; the type of equipment used; the number of times the equipment passes over the same ground; the soil moisture content; the soil surface texture; the amount of ground cover (vegetation and litter); and the recovery rate of the vegetation. Impacts to riparian area and wetland ecosystems would also occur from natural ecological processes and disturbances including flooding, succession, fire, insects, or disease within the next 15 years.

Adverse impacts to riparian area and wetland ecosystems from management activities would be minimized or prevented by the implementation of standards, guidelines, and stipulations in the LRMP, the implementation of project mitigation measures, and direction in the Watershed Conservation Practices Handbook (FSH 2509.25), the ESA, BLM Colorado's Standards for Public Land Health (Standards 3 and 4), BLM Colorado's Guidelines for Livestock Grazing Management, BLM Manual 6840 (Special Status Species Management), BLM Manual 6840.06, and FSM 2622.

Indicators would be used to analyze potential impacts to riparian area and wetland ecosystems from management activities at the project level. Indicators are important ecological components or aspects of riparian area and wetland ecosystems needed to maintain ecosystem integrity and to help to ensure species diversity and population viability. Physical indicators include soil disturbance measured by the acre amount of soil erosion, soil compaction, and soil displacement and soil productivity measured by the amount of detrimental soil disturbance. Biological indicators include the extent and distribution of invasive plants.

Direct and Indirect Impacts

Impacts from Timber Harvest and Mechanical Fuels Treatments

The majority of potential impacts to riparian area and wetland ecosystems from timber harvest and fuels treatments would likely be prevented or mitigated by existing federal policies, together with LRMP standards and guidelines. These protective measures generally prohibit vegetation treatment

using ground-based machinery from occurring within riparian area and wetland ecosystems and often provide additional buffer areas beyond the extent of riparian and wetland vegetation. Vegetation treatment and post-treatment activities could increase the risk of spread of invasive plant species into riparian area and wetland ecosystems from machinery and other equipment proximal to each ecosystem.

The greatest potential impact from these management activities is associated with the construction/reconstruction of roads needed to access the projects. For timber harvest, the impacts would primarily occur on the SJNF because little to no timber harvest would occur on the TRFO. Existing USFS policies do allow for road stream crossings, which could result in direct impacts to riparian area and wetland ecosystems in localized areas. Building additional roads within watersheds of high existing road densities could exacerbate erosion, sedimentation, accelerated runoff, and stream channel downcutting, which indirectly impact riparian area and wetland ecosystems. LRMP guidelines for road densities should maintain existing conditions for riparian area and wetland ecosystems in high road density watersheds.

Impacts from timber harvest and mechanical fuels treatments to riparian area and wetland ecosystems are considered low risk with some anticipated localized impacts. Alternative D has the most potential for impacts to riparian area and wetland ecosystems from timber harvest since it proposes the most acres for timber harvest (4,415 acres) and mechanical fuels treatments (7,700 acres) within those areas. Alternative A has the second most potential for impacts to riparian area and wetland ecosystems from timber harvest (3,075 acres timber harvest and 6,700 acres mechanical fuels treatments), followed by Alternative B (3,035 timber harvest acres and 6,700 mechanical fuels treatments acres).Alternative C has the least potential for impacts to riparian area and wetland ecosystems from timber harvest since it proposes the least acres for timber harvest (2,339 acres) and mechanical fuels treatments (6,700 acres).

Impacts from Fluid and Solid Minerals Development

A large amount of new oil and gas development is projected to occur within the PLAA and GSGP. A small amount of carbon dioxide (CO_2) development would continue to occur primarily on TRFO lands in the Paradox Basin, with a small potential for SJNF lands. Oil and gas development is also expected to continue on leased lands across the SJNF/TRFO. Solid minerals development could occur anywhere minerals of value exist except for areas withdrawn from mineral entry.

If a riparian or wetland area were to occur in areas permitted for locatable minerals (precious metals, etc.) development, the potential for direct and indirect impacts is high because allowing these mining activities is non-discretionary. The magnitude of impact would be determined by the type of mining and the areal extent of mining activities. In general, if a valuable mineral resource were to occur under a riparian area or wetland, the riparian area and wetland ecosystem could be removed or obliterated by mining activities at the discretion of the miner.

The majority of possible direct impacts to riparian area and wetland ecosystems from oil and gas development or saleable minerals (sand, gravel, etc.) activities would likely be prevented or mitigated by existing federal policies, together with LRMP standards and guidelines. These protective measures generally prohibit minerals development from occurring within riparian area and wetland ecosystems and often provide additional buffer areas beyond the extent of riparian and wetland vegetation. Fluid or solid minerals development could increase the risk that invasive plant species would spread into riparian area and wetland ecosystems from machinery and other equipment.

Similar to vegetation treatment activities, the largest potential impacts from oil and gas development or saleable minerals is associated with the construction/reconstruction of roads needed to access wells and other infrastructure. Alternatives A through D would result in approximately 500 miles of new road construction on the SJNF and 226 miles of new road on the TRFO. Inevitably, new road crossings of riparian area and wetland ecosystems are likely with this magnitude of new road construction. Existing USFS and BLM direction allows for road crossings of streams, which could result in direct impacts to riparian area and wetland ecosystems in localized areas.

The potentially large number of new road miles necessary for fluid minerals development would increase watershed road densities. On the TRFO, road densities could increase in many watersheds that already have pre-existing high road densities (above 2 miles/mi2) because the PLAA and GSGP fluid minerals reserves are located within these watersheds. Building additional roads within high road density watersheds could exacerbate erosion, sedimentation, accelerated runoff, and stream channel downcutting (gullying), which increases the risk of negative impacts to riparian area and wetland ecosystems. There is a moderate risk that detectable negative impacts could occur to riparian area and wetland ecosystems within high density watersheds on the TRFO as a result of increasing road densities.

On the SJNF, indirect impacts to riparian area and wetland ecosystems from road construction and increased road densities should be minimized by implementing the LRMP guidelines for road densities. This guideline should prevent road densities from increasing in existing high road density watersheds. There have been cases where spills of hazardous fluids from well pads, pipeline leaks, or vehicle tank spills have killed riparian vegetation in localized areas. This is considered a low to moderate risk to riparian area and wetland ecosystems located close to oil and gas infrastructure.

The direct and indirect effects of solid minerals development are the same for all alternatives. Impacts to riparian area and wetland ecosystems from oil and gas and solid minerals development would occur to varying degrees with all the alternatives. Alternative D has the highest potential for direct and indirect impacts to riparian area and wetland ecosystems from oil and gas development because protective stipulations for riparian and wetland areas are CSU instead of NSO. This increases risk of detectable negative impacts to riparian area and wetland ecosystems associated with road construction and invasive plant species. Alternatives A, B, and C offer the most protection to riparian area and wetland ecosystems from oil and gas development since all of their riparian area and wetland ecosystems–related stipulations are NSO (Table 3.4.1). There is a moderate risk that that detectable negative impacts could occur to riparian area and wetland ecosystems within high-density watersheds on the TRFO as a result of increasing road densities with all alternatives.

Table 3.4.1: Riparian Area and Wetland Ecosystems–related Oil and Gas Leasing Stipulations

Stipulation	Alternative A	Alternative B	Alternative C	Alternative D
Riparian areas and fens	NSO	NSO	NSO	CSU
Chattanooga SBA	NSO	NSO	NSO	CSU

Impacts from Livestock Grazing

Unmanaged livestock grazing and improper livestock grazing management practices are primary causal factors affecting riparian area and wetland ecosystems that are not in proper functioning condition and persist in a degraded condition on the SJNF and TRFO. The other primary factors currently impacting riparian area and wetland ecosystems are water use developments, invasive

species, and the direct and indirect effects of prolonged warm drought. Improper grazing practices can impact riparian area and wetland ecosystems through several mechanisms.

Grazing impacts such as trailing along and through riparian and wetland areas, long seasons of use (generally greater than 20–30 days), and poor timing of livestock grazing can result in long recovery times, soil compaction, soil sloughing, and changes in desirable vegetation species composition. In addition, unmanaged livestock grazing can crush and uproot plants due to trampling. Overgrazing, i.e., concentrated livestock use areas, and longer seasons of use can decrease plant vigor and root reserves, which could result in plant mortality, loss of ground cover, and decreased the litter layers, resulting in a loss of ground cover. Unmanaged livestock can introduce or spread invasive plants (as well as wild ungulates) that compete with native plants for space, water, and nutrients. Unmanaged livestock grazing can decrease soil organic matter and cause soil compaction (Balph and Malechek 1985). Resulting bare soil could in turn reduce infiltration (Dadkhah and Gifford 1981), increase runoff, and increase soil erosion (Orr 1975). For these reasons, unmanaged livestock grazing impacts could decrease the abundance and distribution of desirable native plants and change the composition, structure, and function of the affected riparian area and wetland ecosystems. In particular, native willows are often selectively and excessively browsed by cattle and frequently sustain impacts when unmanaged livestock grazing practices occur over time.

Livestock are managed, and undesirable impacts mitigated, through the AMP. The AMP identifies appropriate seasons of use, livestock grazing systems, allowable forage use guidelines, stocking rates, range improvements necessary to move towards desired conditions, and coordination with other resource needs. Annual operating instructions implement the AMP on an annual basis. The annual operating instructions provide annual pasture rotations, season of use, and allowable use guidelines. Implementation of required management practices and long-term impacts related to grazing are monitored. As necessary, adjustments are made in order to ensure compliance with terms and conditions of grazing permits, which should eliminate most undesirable riparian area and wetland ecosystem impacts caused by livestock grazing.

For Alternatives A through D, stocking rates and permitted livestock use would change between alternatives. Alternative D would have the highest associated risks to riparian area and wetland ecosystems because this alternative proposes the highest cattle stocking rates and the most acres available for cattle grazing. Alternative B has the next highest potential risk to riparian area and wetland ecosystems, followed by Alternatives A then C due to incrementally lower numbers of permitted livestock and fewer suitable acres for livestock grazing.

Impacts from Fire Management Actions

Riparian area and wetland ecosystems are not typically considered fire-dependent ecosystems but are episodically affected by fire as a natural disturbance process. Since the 1980s large wildfires across the western United States have occurred with increased frequency, the duration of the fires has increased, and the length of wildfire season has increased (Westerling et al. 2006). Climatic changes affecting fire activity on the SJNF and TRFO could result in more disturbances to riparian area and wetland ecosystems compared to pre-1980 conditions. It is assumed that the use of prescribed fire, including natural ignitions, on SJNF and TRFO lands would decrease the risk of catastrophic wildfire over time.

The impact of fire on individual plants is dependent on fire intensity/severity, plant growth form, plant height, the plants inherent resistance to fire, the amount of heat received by a plant, the duration of the plants exposure to the heat, and the plants’ ability to recover. Fire can kill plants and decrease ground cover due to the burning of litter and aboveground plant parts. This in turn can lead to soil

erosion, particularly on steep slopes, change habitat conditions for plants, and change forest structural conditions. Fires can introduce and spread invasive plants (such as cheatgrass) that compete with native plants for space, water, and nutrients and alter fire behavior and fire regimes (Colorado State University 2013).

High intensity/severity fire has the greatest risk of negative impacts to riparian area and wetland ecosystems because high intensity/severity fires can kill soil biota, cause mass movement, and create water-repellant hydrophobic soils that reduce infiltration and increase runoff and soil erosion. High intensity/severity fire could have widespread effects to riparian area and wetland ecosystems on a large number of acres of the SJNF and TRFO. Low intensity/severity fire would have localized effects to riparian area and wetland ecosystems on a small number of acres of the SJNF and TRFO, and riparian area and wetland ecosystems are more likely to recover quickly from these fires. Cottonwoods, willows, boxelder, and many herbs that occur in riparian area and wetland ecosystems can generally resprout within a year following fire if belowground plant parts are not severely burned as occurs with a low intensity/severity fire.

Other potential impacts to riparian area and wetland ecosystems from fire management include those associated with fire suppression (creating fire lines, trails, roads, and camps that may remove vegetation and cause soil erosion, soil compaction, and introduction of invasive plant species) and fire reclamation (including seeding, water barring, and the installation of erosion control devices, which would cause short-term soil erosion). It is assumed that these activities would not typically occur directly within riparian or wetland areas.

Alternative A has the least potential for impacts to riparian area and wetland ecosystems from fire management since it proposes the least acres for prescribed fire (47,000 acres). The other alternatives propose 77,000 acres each for prescribed fire and/or fire managed for resource benefit and have similar risks to riparian area and wetland ecosystems.

Impacts from Recreation

Riparian areas on the SJNF and TRFO are often places that attract recreational activities such motorized travel, camping, hiking, mountain biking, and horseback riding. If these activities are unmanaged, they have the potential to impact riparian area and wetland ecosystems by physically removing vegetation, or crushing or displacing shrubs and herbs, which results in mortality to plants and the loss of canopy and ground cover. If unmanaged recreation occurs in riparian or wetland areas when soils are saturated, severe rutting often occurs, which can lead to erosion and loss of native riparian area and wetland ecosystem vegetation. Recreational activities in riparian area and wetland ecosystems can introduce and spread invasive plants that compete with native plants for space, water, and nutrients. The extent of these impacts would depend on the vegetation type, plant growth form (graminoids are more resistant to damage compared to trees, shrubs, and forbs), slope, soil type, season, and weather conditions (Hill and Pickering 2009a). Recreation can have localized effects of varying magnitude anywhere riparian area and wetland ecosystems exist on the SJNF and TRFO.

Impacts to riparian area and wetland ecosystems from unmanaged recreational activities would be similar for all the alternatives. They have a moderate risk of creating localized impacts to riparian and wetland areas and to saturated soils. Alternative A has the most potential for adverse impacts to riparian area and wetland ecosystems from motorized overground recreation, because it proposes the most acres for motorized travel and because it is the only alternative that allows motorized travel off of existing roads and trails. Alternative D would have the second most potential for motorized travel impacts to riparian area and wetland ecosystems, followed by Alternative B. Alternative C has

the least potential for motorized travel impacts to riparian area and wetland ecosystems since it proposes the least acres for motorized overground travel. Impacts are not anticipated from motorized oversnow recreation to riparian area and wetland ecosystems with any alternative.

Impacts from Climate Change

Recent research and future species distribution modeling predict large changes in the distributions of species and vegetation types in the western interior of the United States in response to climate change. Changes to riparian area and wetland ecosystems from climate change within the next 15 years are likely to occur. Riparian area and wetland ecosystem systems themselves would have varying responses related to climate change depending on the existing conditions of each system. Riparian area and wetland ecosystems that are healthy and functionally and structurally intact are much more resilient and resistant to the effects of a changing climate than those in poor condition.

Some riparian area and wetland ecosystems are already experiencing environmental stresses from long-term warm drought in southwest Colorado (e.g., Dolores corridor riparian areas). If climate continues to warm and drought is more frequent and of long duration, it is expected impacts to riparian area and wetland ecosystems would expand in extent and be detectable at higher-elevation zones. Riparian area and wetland ecosystem plant species (including special status plant species) responses to climate change would depend not only on their physiological tolerances but also on their phenology, establishment properties, biotic interactions, and capacity to evolve and migrate.

Cumulative Impacts

Past management activities (including timber harvest, mechanical fuels treatments, oil and gas development, livestock grazing, prescribed fire, recreation, and solid minerals development on federal and non-federal lands within the planning area) have caused adverse impacts to riparian area and wetland ecosystems, as described above. Many of the adverse impacts associated with those activities (soils disturbances) have recovered due to restoration efforts and natural processes. Many other adverse impacts to riparian area and wetland ecosystems (particularly those associated with oil and gas development, and livestock grazing) are still evident on the SJNF and TRFO and would remain evident over the next 15 years. Project designs and the proper implementation of mitigation measures, COAs, stipulations, standards, and guidelines have served to protect the composition, structure, and function of riparian area and wetland ecosystems on most past projects.

Additional adverse impacts to riparian area and wetland ecosystems (as described above) on federal and non-federal lands within the planning area would occur from the implementation of management activities in the LRMP and from foreseeable future management activities beyond the 15-year life of the LRMP. Those impacts are anticipated to be localized and would not adversely affect the ecological integrity of most of the affected riparian area and wetland ecosystems and would not affect the ability of most riparian area and wetland ecosystems to achieve their desired conditions in the LRMP. One exception could be the withdrawal of water as a result of dams, diversions, and other water development projects located on private lands upstream of the SJNF and TRFO. Projects such as these could affect many acres of riparian areas.

The cumulative impact of past, present, and foreseeable future management activities on federal and non-federal lands within the planning area could cause adverse impacts to riparian area and wetland ecosystems, as described above, on a small percent of the planning area. Those impacts would not adversely affect the ecological integrity of most of the affected riparian area and wetland ecosystems, would likely not change the diversity of these ecosystems, would not adversely affect the diversity or viability of plant species, and would not likely affect the ability of most riparian area and wetland

ecosystems to achieve their desired conditions in the LRMP. Project designs, the implementation of standards, guidelines, and stipulations in the LRMP, and the implementation of mitigation measures would minimize adverse cumulative impacts to riparian area and wetland ecosystems on federal lands.

3.5 Aquatic Ecosystems and Fisheries

3.5.1 Introduction

There is a direct correlation between public needs and concerns for adequate supplies of clean water and subsequent impacts on fisheries and aquatic species. The waters of the planning area support a variety of ecosystems. In southwest Colorado, these aquatic communities and ecosystems can be found at many different elevations and within many different habitats. In general, the most common aquatic biota within the planning area can be categorized as fishes, aquatic plants, aquatic insects, and the embryonic and larval stages of amphibians (e.g., frogs and toads) (see Section 3.3, Terrestrial Wildlife). Less obvious and less well understood biota include the phytoplankton and algal, zooplankton, and microbe species associated with aquatic environments (especially in lakes, reservoirs, and ponds). Undoubtedly, these organisms play important roles in ecosystem processes (including nutrient cycling and energy fluxes, as well as in the composition of aquatic food chains).

Within the planning area, most aquatic insects or macroinvertebrate communities are composed of bottom-dwelling insects that live among the boulders, cobble, and gravel in streams. They are dominated by taxonomic orders that require clean water. Macroinvertebrates such as true flies (Diptera), mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Tricoptera) are abundant in many streams and rivers within the planning area. The richness, distribution, and abundance of macroinvertebrates are often indicators of the water quality conditions in their environments.

The planning area contains native and desired non-native fish species. Although non-native fish introductions have increased fish diversity, they have also resulted in negative impacts to native fish populations. Historic and current forest/rangeland management activities have impacted, and may continue to impact, the characteristics and functions of aquatic ecosystems by reducing the richness, distribution, and abundance of macroinvertebrates and native fishes. Accommodating increasing public needs for water while, at the same time, protecting these aquatic ecosystems will be one of the biggest challenges to public land management over the next few decades (see Volume II, LRMP Section 2.1).

This chapter describes the existing conditions and trends for the native and desired non-native fish species within the planning area, as well as the anticipated environmental impacts related to implementing the alternatives (see Chapter 2).

3.5.2 Legal and Administrative Framework

Standards and guidelines for watershed, soils, and aquatic habitat management are presented in the LRMP and describe the environmental protection measures that would be applied to all of the alternatives at the project level in order to protect, enhance, and, where appropriate, improve aquatic resources. In addition, requirements from the following list of policy, law, and other direction would apply to management of fisheries and aquatic species and would mitigate the potential impacts of management activities:

- FSM 2600, Wildlife, Fish, and Sensitive Plant Habitat Management

- FSH 2609.13, Wildlife and Fisheries Program Management Handbook
- BLM Manual 6720, Aquatic Resource Management
- BLM Manual 6840, Special Status Species Management
- FSH 2509.25, Watershed Conservation Practices Handbook (Region 2 Supplement)
- USDI and U.S. Department of Agriculture (USDA) Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (BLM and USFS 2007)
- The ESA of 1973 (16 USC 1531 et seq.)
- Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (USFWS 1987)
- San Juan River Basin Recovery Implementation Program (USFWS 1995, 2003b)
- Razorback Sucker Recovery Plan (USFWS 2002b)
- Colorado Squawfish Recovery Plan (USFWS 1991)
- Bonytail Chub Recovery Plan (USFWS 1990a)
- Humpback Chub Recovery Plan (USFWS 1990b)
- The Greenback Cutthroat Trout Recovery Plan (USFWS 1998)
- The Conservation Agreement and Strategy for Colorado River Cutthroat Trout in the States of Colorado, Utah, and Wyoming (Colorado River Cutthroat Trout Task Force 2001) signed by the Region 2 USFS Regional Forester (March 29, 2001) and the BLM Colorado State Director (March 26, 2001)
- The Range-wide Conservation Agreement and Strategy for Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker (September) (Utah Department of Natural Resources 2006)
- Boreal Toad Conservation Plan and Agreement (Boreal Toad Recovery Team and Technical Advisory Group 2001)
- Fungus Contamination Prevention Guidelines Found in CPW Procedures for Monitoring and Surveying Boreal Toad Populations (CPW 2004)
- Inventory and Monitoring: Recommended Techniques for Reptiles and Amphibians (Graeter et al. 2013)
- Volume III, Appendix H, Oil and Gas Leasing Stipulations

3.5.3 Affected Environment

Existing Condition and Trends

Threatened and Endangered Fish Species

In relation to the planning area, five fish species, and their designated critical habitats, are federally listed (bonytail chub [*Gila elegans*], humpback chub [*G. cypha*], Colorado pikeminnow [*Ptychocheilus lucius*], razorback sucker [*Xyrauchen texanus*], and greenback cutthroat trout [*Oncorhynchus clarki stomias*]) (Table 3.5.1; USFWS 1994b). The bonytail chub and Colorado pikeminnow are also listed as endangered, and the humpback chub and razorback sucker are also listed as threatened by the State of Colorado.

Table 3.5.1: Federally Listed Fish Species on the SJNF and TRFO

Species	Status	Potential for Occurrence on BLM Lands	Potential for Occurrence on NFS lands
Bonytail chub (Gila elegans)	Endangered	No	No
Colorado pikeminnow (*Ptychocheilus lucius*)	Endangered	Yes	No
Humpback chub (Gila cypha)	Endangered	No	No
Razorback sucker (*Xyrauchen texanus*)	Endangered	No	No
Greenback cutthroat trout (*Oncorhynchus clarki stomias*)	Threatened	No	Yes

Four species (bonytail chub, humpback chub, Colorado pikeminnow, and razorback sucker) are found downstream of the planning area in the mainstems and some tributary streams of the San Juan and Dolores Rivers. The lineage greenback cutthroat trout is found in Stoner Creek, Little Taylor Creek, Rio Lado Creek, and Roaring Forks Creek on NFS lands in the upper portions of the Dolores River system within the planning area. These species fall under the purview of Section 7 of the ESA (16 USC 1531 et seq.), which outlines the procedures for federal interagency cooperation designed to conserve federally listed species and designated critical habitats. Section 7(a)(2) of the ESA states that any action authorized, funded, or carried out by a federal agency would not likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

Within the planning area, management activities may impact these five threatened or endangered fish species and/or their potential habitat. Activities that result in water depletions, influence stream flow, or degrade water quality may impact these species. Species management for the four downstream fish (bonytail chub, humpback chub, Colorado pikeminnow, and razorback sucker) is guided by two USFWS recovery implementation programs. One addresses the needs for the San Juan River populations, while the other addresses the needs for the upper Colorado River populations (including the Dolores River system). Species management for the greenback cutthroat trout is guided by the USFWS recovery plan for Colorado (USFWS 1998) and recent policy direction for lineage greenback cutthroat trout. As a result, consultation with the USFWS is frequently required for many project-level activities within the planning area under Section 7(c) of the ESA. A consultation is always required for projects and activities with proposed water depletions. BMPs and mitigation measures have been, and would continue to be implemented in order to minimize impacts to the water quality of local streams and rivers, and, subsequently, to all five threatened and endangered species. Looking towards the future, many of the same issues with past management present themselves. Management activities such as timber harvest and livestock grazing may not differ measurably from those conducted under the current LRMP; however, there would be greater demands placed on water consumption and in-stream flows, particularly with regard to oil and gas development projected for the next 15 to 20 years.

With a changing climate, the observed temperature record in southwest Colorado shows average annual warming of about 2 degrees Fahrenheit over the last 30 years (Western Water Assessment 2008). Since river runoff on the SJNF is primarily driven by snowmelt, the warming climate from 1978 to 2004 has caused the onset of spring snowmelt and river snowmelt runoff to occur two to three weeks earlier in southwest Colorado (Clow 2007). Changes in the timing and amount of runoff may

impact aquatic ecosystems. Cold water fish species, especially lineage greenback cutthroat trout, may be especially vulnerable to increasing stream temperatures and hydrologic changes such as reduced late-season base stream flows (Nydick et al. 2012). Changes in physical hydrology may favor some non-native or invasive aquatic species and may increase the incidence of diseases such as whirling disease, adding stress to this endangered species.

U.S. Forest Service and Bureau of Land Management Sensitive Fish Species

In relation to the planning area, four native fish species are listed as both USFS and BLM sensitive species: roundtail chub (*Gila robusta*), flannelmouth sucker (*Catostomus latipinnis*), Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*), and bluehead sucker (*Catostomus discobolus*) (Table 3.5.2). All four species are also identified as species of special concern by the State of Colorado.

Table 3.5.2: USFS and BLM Sensitive fish species

Species	BLM Sensitive Species	USFS Sensitive Species	Global Ranking*	National Ranking*
Roundtail Chub (Gila robusta)	Yes	Yes	G3	N3
Flannelmouth sucker (Catostomus latipinnis)	Yes	Yes	G3G4	N3N4
Colorado River cutthroat trout (Oncorhynchus clarki pleuriticus)	Yes	Yes	G4T3	N2N3
Bluehead sucker (Catostomus discobolus)	Yes	Yes	G4	N4
*Ranking and status categories through the NatureServe Global Conservation Status Rank Guidance (2006). Rankings are as follows: 1 = critically imperiled, 2 = imperiled, 3 = vulnerable to extirpation, 4 = apparently secure, 5 = demonstrably widespread, abundant, and secure. For more detailed information concerning the historic range, habitat needs, and current distribution of these four species, consult the Biological Evaluation in the planning files for this LRMP/FEIS (see Appendix T).				

Generally, the roundtail chub, flannelmouth sucker, and bluehead sucker are found in mainstem rivers and some tributary streams at lower elevations on both BLM and NFS lands within the planning area (including the Dolores, Mancos, La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo Rivers, as well as Disappointment Creek). The Colorado River cutthroat trout populations, on the other hand, are found mostly in headwater streams and lakes on only NFS lands that are tributary to the San Juan River system. The Hermosa Creek watershed is especially important for the conservation and recovery of this species in southwest Colorado. Streams on the SJNF with Colorado River cutthroat trout are:

- Augustora Creek
- Beaver Creek
- Himes Creek
- Red Creek
- Flint Creek
- Cutthroat Creek
- Headache Creek
- North Fork Sand Creek
- Falls Creek
- East Fork Piedra River
- Sand Creek
- Cimarrona Creek
- East Fork Coldwater Creek
- West Fork Coldwater Creek
- Flagler Fork
- West Virginia Gulch
- East Fork Shearer Creek
- North Fork Shearer Creek

- West Fork Shearer Creek
- Big Bend Creek
- Clear Creek
- East Fork Hermosa Creek
- Shearer Creek
- Castle Creek
- Engine Creek
- Grasshopper Creek
- Pasture Creek
- Bear Creek
- Little Bear Creek
- Hermosa Creek #2
- Deep Creek

The USFS and BLM sensitive species are species for which some management actions and direction are necessary in order to prevent listing of these species under the ESA. Management direction is also necessary so that land management activities do not contribute to a loss of species viability. Although none of the above four native fish species is a candidate species under ESA, the decline of Colorado River cutthroat trout has been so severe that this subspecies of cutthroat was petitioned for federal listing several years ago. The USFWS has decided against listing, at this time, because no evidence of major declines in the overall distribution or abundance over the last several decades was found, and because of restoration efforts by CPW, the USFS, and other groups. These restoration efforts included stream reclamation, barrier planning and design, development of two broodstocks from local pure Colorado River cutthroat trout strains, stocking of barren waters with these pure strains, genetic testing of local populations, etc. The Colorado River cutthroat trout is also listed as a USFS MIS. To restore Colorado River cutthroat trout populations, the management priorities in the LRMP focus on the continued habitat improvement projects and reintroduction efforts in cooperation with CPW and other groups.

Colorado River cutthroat trout populations can be susceptible to overangling. The CPW has an artificial lures and catch and release regulation on many Colorado River cutthroat trout streams. Angling mortality is rarely heavy enough to reduce population viability, but it can change the age structure of fish populations. Loss of breeding individuals could lead to increased inbreeding.

The populations of roundtail chub, flannelmouth sucker, Colorado River cutthroat trout, and bluehead sucker are all in decline (Bezzerides and Bestgen 2002; Weitzel 2002; Wheeler 1997; Young 1995). The reasons for this decline are primarily due to the alteration of stream flow regimes in mainstem rivers and tributary streams resulting from water developments, water diversions, ongoing drought impacts, changes in water temperature regimes, interactions with non-native species (hybridization with non-native white suckers [*Catostomus commersonii*] is a serious threat to flannelmouth and bluehead suckers), and overall degradation of habitat. Of the three downriver species, bluehead sucker appears to be more at risk to impacts than are roundtail chub or flannelmouth sucker. This is due to current water developments, water diversions, and/or drought-related impacts (Anderson and Stewart 2007). For the SJNF, specifically, flannelmouth sucker is also of concern.

With a changing climate, the observed temperature record in southwest Colorado shows average annual warming of about 2 degrees Fahrenheit over the last 30 years (Western Water Assessment 2008). Since river runoff on the SJNF is primarily driven by snowmelt, the warming climate from 1978 to 2004 has caused the onset of spring snowmelt and river snowmelt runoff to occur two to three weeks earlier in southwest Colorado (Clow 2007). Changes in the timing and amount of runoff may impact aquatic ecosystems. Cold water fish species, especially Colorado River cutthroat trout, may be especially vulnerable to increasing stream temperatures and hydrologic changes such as reduced late-season base stream flows (Nydick et al. 2012). Changes in physical hydrology may favor some non-native or invasive aquatic species and may increase the incidence of diseases such as whirling disease, adding risks to this sensitive species.

U.S. Forest Service Management Indicator Species/Common Cold-water Fish

Within the planning area, four common, cold-water trout species are widely distributed and abundant in most rivers and perennial streams, as well as in many of the larger and deeper reservoirs on both BLM lands and national forest lands. The four species, brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), cutthroat trout (*Oncorhynchus clarki*), and rainbow trout (*Oncorhynchus mykiss*), are considered USFS MIS (Table 3.5.3). Only the Colorado River cutthroat trout subspecies is known to be a native. There is an ongoing debate over the native range of lineage greenback cutthroat trout. The other trout species are non-native. MIS are monitored in order to assess the impacts of management activities on their habitat or population levels. Although the Colorado River cutthroat trout is a USFS and BLM sensitive species, it is also listed as an MIS. The brook, brown, other cutthroat, and rainbow trout are listed as MIS due to their recreational and economic value.

Table 3.5.3: USFS Management Indicator Fish Species

Management Indicator Species	LRMP Issues For Selection
Trout species (Colorado River cutthroat, cutthroat spp., brook, brown, and rainbow) (Oncorhynchus clarki pleuriticus) (Oncorhynchus clarki sp.) (Salvelinus fontinalis) (Salmo trutta) (Oncorhynchus mykiss)	• Effects to water quantity due to water depletions associated with reservoirs, diversions, and oil and gas development. • Effects to water quality due to soil erosion and sedimentation associated with ground-disturbing activities (fuels treatments, oil and gas development, timber harvest, livestock grazing, road construction, and recreation).

Generally, brook and brown trout have self-sustaining populations throughout the planning area. Although some streams have self-sustaining populations, cutthroat and rainbow trout population levels are more likely influenced by current stocking efforts by CPW. All four trout species are managed as game and sport fish, and may be harvested (subject to state fishing regulations).

Impacts to these four cold-water trout species related to land management activities have resulted primarily from water quantity and water quality influences. Lack of, or decreased, stream flow has resulted in the greatest impacts to these species, coupled with stream temperature increases. Over the history of the planning area, hundreds of water diversions and ditches have been constructed, especially in the most downstream sections of rivers and streams near agricultural lands, towns, cities, and residential developments. Water storage projects, trans-basin diversions, and numerous water wells are also located on the SJNF and TRFO. With persistent drought conditions and increased population growth in southwest Colorado, new private water rights filings within the planning area would continue. Decreased stream flows can impact aquatic habitat and trout populations by reducing, or eliminating, the quantity and quality of suitable habitat, altering water temperature regimes (e.g., increasing stream temperatures), and, subsequently, by reducing dissolved oxygen levels (Marcus et al. 1990; Meehan et al. 1977). These impacts could be more pronounced during periods of natural cyclic flow reductions (during fall and winter) or during summer months in a drought.

For some rivers or streams, minimum in-stream flow water rights have been acquired by the Colorado Water Conservation Board (CWCB) in order to protect these fisheries from being impacted by some existing, and all new, water users. However, most existing consumptive uses (e.g., irrigation) on

these rivers and streams have priority over the non-consumptive CWCB in-stream flow rights. On fully appropriated rivers or streams, and during high-use periods, all surface flows may be diverted, leaving sections of stream dewatered. For some of these impacted areas, a small amount of aquatic habitat may be maintained by groundwater in-flow and return-flow from diversions. A loss in stream flow would also reduce a stream's ability to convey sediment downstream and result in deposition, which may, in turn, impact the numbers and diversity of benthic macroinvertebrates, and, ultimately, aquatic habitat. To provide better protection of fisheries and aquatic ecosystems, an in-stream flow standard has been developed for the LRMP.

Water quality has had the next greatest impact on these four trout species. Throughout the planning area, sediment is the greatest water quality concern. Beyond natural sources, human-caused sediment loading in streams may result from existing or recently constructed roads, gas well pads, timber harvesting, historic placer and hydraulic mining, grazing, OHV use, and other land-disturbing actions. Over the life of the current LRMP (approved in 1983) sediment production has declined in areas of the SJNF and TRFO where sediment reduction activities and projects have been implemented, such as in the upper Animas River Basin or where roads and well pads have stabilized.

Locally, some rangelands in the western portions of the planning area have large areas of exposed marine shale. Marine shales are typically highly erosive and can increase salinity in streams. The BLM, the USFS, and the Colorado River Salinity Control Forum have spent substantial funding in order to minimize salt delivery to the Colorado River. In many areas, these agencies have reduced salinity and sediment loading. However, where sediment production is extremely high, salt concentrations in streams and rivers can be at toxic levels for fish survival. This would continue to be a management challenge, especially with the oil and gas leasing and projected development in the PLAA.

Fine sediment deposition in streams and rivers can also reduce intergravel dissolved oxygen and increase stream temperatures, which can, in turn, impact fish habitat (Meehan 1991). In this case, the USFS and BLM would continue to use BMPs in the Watershed Conservation Practices Handbook (USFS 2006a) and Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (BLM and USFS 2007) to effectively minimize effects to fisheries and aquatic ecosystems. In other areas (the Silverton area/upper Animas River Basin, and the Rico, Mancos, and La Plata City areas), acid drainage and heavy metal loading from hard-rock mining activities, as well as from natural sources, into nearby rivers and streams limit fish and aquatic populations and, depending on the species, may be toxic (Simon et al. 2000). In this area, the USFS and BLM would continue to participate with the Animas River stakeholders in implementing projects to minimize these effects. Atmospheric deposition of metals, oxides of sulfur, and nitrogen from coal-fired power plants in New Mexico and Arizona are known to impact the water quality of many fish-bearing water bodies (see Section 3.12, Air Quality).

Where fishery surveys and inventories have been conducted within the planning area, the current trends for the habitat and population levels for the brook, brown, cutthroat, and rainbow trout are all generally decreasing. Much of this monitoring information has been collected in drainages subject to water depletions (including streams with water developments or water diversions, and/or streams that area strongly influenced by drought-related impacts over the last 15 to 17 years). The combined stress of reduced stream flows, higher water temperatures, poorer water quality, and resulting marginal habitat conditions have decreased population levels of these species from historic levels. With the drought continuing in southwest Colorado, fishery habitat is predicted to decrease into the future. However, trout populations may remain stable due to artificial stocking efforts for some

species (including rainbow and cutthroat trout). All four species would continue to be harvested in accordance with state fishing regulations.

Whirling disease occurs in many fish hatcheries throughout Colorado and infected fish have been stocked statewide. Whirling disease is a parasitic, protozoan that attacks the cartilage of young fish. Whirling disease affects rainbow, cutthroat, brook, and to a lesser degree, brown trout. Mortality rates for rainbow, cutthroat, and brook trout can exceed 80%. Dramatic declines in rainbow trout populations have been recorded in the Madison River in Montana, and the Colorado and Fryingpan Rivers in Colorado. Research has shown cutthroat trout are as susceptible as rainbows. Infected fish, birds, mammals, boats, fishermen, and other equipment can spread the spores from area to area.

In spite of the trends, land management activities within the planning area may result in small localized impacts to habitat quality or to population levels of these four trout species. Generally, the habitat and population of these four trout species would be maintained and protected (Colorado Division of Wildlife 2002; Colorado Natural Heritage Program 2002; USFWS 2002b, 2002c; USFS 2005). This would be due to their widespread distribution and abundance, continued artificial stocking efforts by CPW for some species, to state-regulated fishing pressure, the utilization of BMPs designed to minimize impacts on water quality, and the implementation of mitigation measures designed to reduce impacts on fish populations and habitat. However, any activities that result in water depletions, influence stream flow, or increase water temperatures may result in greater impacts to these four cold-water trout species.

Common Warm-water Fish

Southwest Colorado contains several warm-water fish species that are found primarily in the larger reservoirs (including within the planning area). These warm-water species include northern pike (*Esox lucius*), walleye (*Sander vitreus*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*M. salmoides*), crappie (*Pomoxis* sp.), yellow perch (*Perca flavescens*), bluegill (*Lepomis macrochirus*), and channel catfish (*Ictalurus punctatus*). All these warm-water fishes are non-native and primarily found in McPhee, Narraguinnep, Jackson Gulch, Vallecito, and Navajo Reservoirs. These warm-water species are fished for sport and recreation, and are subject to state fishing regulations.

Currently, the populations for these warm-water fish are stable. This is due to self-reproducing populations and/or to artificial stocking by CPW. Mercury contamination has occurred in fish from McPhee, Narraguinnep, Navajo, and Vallecito Reservoirs, especially in the larger, non-native predators (northern pike and walleye). The contamination seems to be more of a public health hazard, rather than a fish injury concern. All species would continue to be game fish and harvested in accordance with state fishing regulations.

Future management activities within the planning area would likely not impact or change these warm-water fish. The mercury-contaminated fish issue is speculated to be linked to air pollution from the Four Corners coal-fired power plants in New Mexico and Arizona; however, this has not yet been scientifically validated (see Section 3.12, Air Quality).

3.5.4 Environmental Consequences

Direct and Indirect Impacts

Almost all of the multiple-use activities conducted within the planning area and described in this analysis have the potential to impact aquatic ecosystems. Based on the assessment of current

aquatic conditions, it appears that the greatest risks to fish and aquatic species are from management activities that directly impact streams, riparian areas and wetlands ecosystems, and/or aquatic community composition. Activities with greater impacts include water use and development projects, road construction and road management, oil and gas development, hard-rock mining, mining reclamation, and grazing. Activities with lesser impacts include timber harvesting, mechanical fuels reduction projects, rangeland treatments, wildfire, prescribed burns, utility corridor projects, ski area modifications and expansion, and OHV use.

The uplands of watersheds appear to be more resilient; therefore, management activities that directly impact the uplands tend to pose a smaller risk to fisheries and aquatic species (except in erosive watersheds). Generally, resilient uplands are further away from stream channels and riparian areas, and/or have the ability for vegetation and ground debris to filter out erosion from reaching stream channels and/or headwater streams to store sediment.

Environmental consequences related to multiple-use activities are generally expected to be proportional to the magnitude and extent of activities that occur in erosive or sensitive watersheds (see Section 3.6, Water Resources for watersheds at risk and/or in poor condition). Streams in other watersheds may be more resilient to anthropogenic influences due to their geology, soils, vegetation cover, or relative intactness of riparian areas and wetlands ecosystems. Potential impacts would be minimized through the application of standards and guidelines, including the referenced management direction earlier in this section, that frame BMPs applied to NFS and BLM lands, and standards and guidelines described in the LRMP such as not allowing new road construction in riparian areas unless perpendicular to the stream.

Surface water, groundwater, floodplains, riparian areas and wetlands ecosystems, and habitat for fish and other aquatic species are all closely related. BLM and USFS manuals and handbooks, including the USFS Watershed Conservation Practices Handbook (USFS 2006a) and the BLM’s Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development -The Gold Book (BLM and USFS 2007), prescribe extensive measures designed to protect soil, riparian, and aquatic resources. When applicable, mitigation measures would be implemented and would be effective in reducing impacts, as confirmed from monitoring of their application. Adverse impacts to the aforementioned resources from management activities are expected to be generally minor and localized, as the SJNF and TRFO have determined as a result of monitoring management activities under the current LRMP. However, as the intensities and the extent of activities increase, for example, under Alternative D compared to other alternatives, there may be an increased risk that conservation practices would not be as cumulatively effective over time. Therefore, it is reasonable to presume that alternatives prescribing greater levels of multiple-use activities (Alternatives A and D) than the other Alternatives (B and C) may pose greater risks to fisheries and aquatic ecosystems and may require additional, appropriate project design and mitigation approaches.

For each of the management activities described below, the environmental consequences for fisheries and aquatic species are compared by alternative.

Impacts to Aquatic Ecosystems and Fish Species from Water Use and Development Project Decisions

The impacts related to water use and development projects (including diversion ditches, storage reservoirs, pipelines, and wells) on water quantity, timing, water quality, fisheries, and aquatic species are described in Section 3.6, Water Resources. The primary impact to aquatic ecosystems would be from reduced or eliminated stream flows and the resulting degradation or elimination of aquatic habitats. Additional impacts on fisheries and aquatic species may include increased stream

temperatures and reduced dissolved oxygen levels. These impacts may be more pronounced during periods of natural cyclic flow reductions (during fall and winter) or during summer months in a drought. Winter base flows would also be reduced when ski area snowmaking operations drain water from streams and/or from water wells that are likely connected by groundwater to streams. This may limit habitat and populations of fish and other aquatic species, which may, in turn, disrupt the life cycles of such species.

Threatened or Endangered Species

Under all of the alternatives, the impacts related to ongoing water use and new development projects would be adverse to bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker found in the San Juan and Dolores Rivers downstream of the planning area. The impacts would be mainly due to water depletion and reduced stream flows (i.e., reduced or eliminated fishery habitat, increased stream temperatures, and reduced dissolved oxygen levels). For all of the alternatives, depending on the location of the water use and development project, the impacts on the lineage greenback cutthroat trout (found only in four stream segments on NFS lands) would generally be no impact. If a new water development project were constructed upstream of a population, an adverse impact would occur to greenback cutthroat trout immediately downstream.

Sensitive Species

Under all of the alternatives, ongoing water use and new development projects would result in adverse impacts to the roundtail chub, flannelmouth sucker, and bluehead sucker found immediately downstream in the Dolores, Mancos, La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo Rivers at the lower elevations of the planning area. The impacts of reduced or eliminated fishery habitat would result from water depletions and reduced stream flows. For all of the alternatives, depending on the location of the water use and development project, the impacts on the Colorado River cutthroat trout (found only on NFS lands) could vary from no impact to an adverse impact immediately downstream. The impacts would be mainly due to water depletions, reduced stream flows, and to the subsequent impacts on fishery habitat available for use.

Management Indicator Species and Common Cold-water Fish

Under all of the alternatives, the impacts from ongoing water use and new development projects on brook, brown, cutthroat, and rainbow trout may be adverse immediately downstream from these projects. Due to the widespread distribution and abundance of these trout, their viability may not be threatened. The impacts resulting from some water use and development projects may be substantial to fisheries and aquatic ecosystems; however, the impacts are not expected to vary between the alternatives. This is because the demand for water use authorizations is driven by project proponents, rather than by SJNF and TRFO programs or budgets.

Comparison of Alternatives

The impacts related to water use and development projects on fisheries are not expected to vary between the alternatives. This is because the demand for water use authorizations is driven by project proponents, rather than by SJNF and TRFO programs or budgets. The impacts on the four, warm-water, downstream endangered species, or three, warm-water sensitive species would be adverse downstream of water use and development projects (due to water depletion and reduced stream flows). The impacts to the lineage greenback cutthroat trout and Colorado River cutthroat trout would vary from no impact to adverse impacts, depending on the location of the water use and development project. For common, cold water trout, the impacts would be localized and adverse

immediately downstream from these projects (due to reduced or eliminated stream flows and/or fishery habitat). To minimize impacts, an in-stream flow standard has been developed for the LRMP.

Impacts to Aquatic Ecosystems and Fish Species from Livestock Grazing Decisions and Big Game Use

The impacts related to livestock grazing and big game use on water quantity, water quality, fisheries, and aquatic species are discussed in Section 3.6, Water Resources. The primary impact to fisheries and aquatic species would be mainly due to degraded habitat resulting from erosion and sedimentation and increased stream temperatures caused by long-term concentrated grazing in riparian areas where stream bank trampling and trailing, stream widening, and stream-side vegetation removal are occurring. Another impact to fisheries and aquatic species would be due to the construction of new stock ponds, and livestock water and the resulting water depletion and potentially reduced stream flows. Application of standards and guidelines and referenced documents and manuals should ensure proper rangeland management and reduce the effects to fisheries and aquatic ecosystems.

<u>Threatened or Endangered Species</u>

Under all of the alternatives, the impacts related to livestock grazing and big game use on bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker would generally be minor because they are found downstream of the planning area. The impacts of sedimentation and increased stream temperatures from livestock grazing and big game use would minimally impact their aquatic habitat. This may even be true under Alternative D (which may result in the greatest impacts). However, under all alternatives, where new stock ponds or livestock water are constructed, this water depletion and potentially reduced stream flows would be considered an adverse impact to these endangered downstream fisheries and require coordination and consultation with the USFWS under Section 7 of the ESA. For all of the alternatives, the impacts from livestock grazing and big game use may affect individual lineage greenback cutthroat trout (found only in four stream segments on NFS lands). Overall, however, impacts are generally expected to be minor for the populations of greenback cutthroat trout. Due to the delay in influencing existing conditions, Alternative C (with its reductions in suitable and available livestock grazing acres) may reduce grazing impacts on fisheries in the long term, but not, however, in the short term. Under Alternative D (with its increases in suitable and available livestock grazing acres), grazing may increase impacts to this fishery in the long term, but not in the short term. There would be localized improvements in grazing management. In addition, rangeland health improvement projects would be implemented. However, the impacts of sediment and increased water temperatures on fishery habitat quality would continue.

<u>Sensitive Species</u>

Under all of the alternatives, the impacts related to livestock grazing and big game use may adversely affect specific individuals of the species. Overall, however, they would be minor for the populations of roundtail chub, flannelmouth sucker, and bluehead sucker that are found at the lower elevations of the planning area, except where new stock ponds or livestock water are constructed. Impacts would also be minor for the populations of Colorado River cutthroat trout (found only on NFS lands) because of implementation of BMPs, manual and referenced direction, etc., in AMPs and annual operating plans. Due to the delay in influencing existing conditions, Alternative C (with its reductions in suitable and available livestock grazing acres) may reduce grazing impacts on fisheries in the long term, but not, however, in the short term. Under Alternative D (with its increases in suitable and available livestock grazing acres), grazing may increase impacts to these fisheries in the long term, but not, however, in the short term. There would be localized improvements in grazing management. In

addition, rangeland health improvement projects would be implemented. However, the impacts of sediment and increased water temperatures on fishery habitat quality would continue.

Management Indicator Species and Common Cold-water Fish

The potential impacts on brook, brown, cutthroat, and rainbow trout related to livestock grazing would be nearly equal under Alternatives A and B, having similar objectives for livestock grazing. The primary impact to fisheries related to grazing would be mainly due to degraded habitat (resulting from erosion, sedimentation, and increased stream temperatures). However, based on experience in managing the livestock program and addressing these issues, the overall impacts would be generally minor under the LRMP and alternatives. With reductions in suitable and available livestock grazing acres (e.g., closing some active sheep allotments), the impacts of livestock grazing on fisheries under Alternative C would be less in the long term, but would remain similar to Alternatives A and B in the short term. With increases in suitable and available livestock grazing acres (e.g., stocking vacant sheep allotments), Alternative D would increase adverse impacts to these trout species in the long term, but continue impacts similar to Alternatives A and B in the short term. Due to their widespread distribution and abundance, the viability of these fish populations would not be threatened under any of the alternatives. Protection and improvement of riparian areas and wetlands ecosystems would continue to receive emphasis under all of the alternatives.

Comparison of Alternatives

Overall, the long-term impacts related to livestock grazing and big game use on fisheries and aquatic habitat would be minor. By alternative, the greatest impacts would be under Alternative D, followed by Alternatives A and B with similar impacts, and then by Alternative C. These impacts vary by alternative due to the variations in amounts of suitable and available livestock grazing acreages proposed under each alternative and to the corresponding impacts on fish habitat from sediment and increased stream temperatures.

Impacts to Aquatic Ecosystems and Fish Species from Decisions Related to Road Management and Construction

The impacts related to roads and trails on stream flow and sediment production are described in Section 3.6, Water Resources. With regard to fisheries and aquatic species, heavy sediment loads can reduce pool depths, bury stream substrates and spawning gravels, adhere to aquatic insects and the gills of fish, increase habitat for tubifex worms (*Tubifex tubifex*) (an intermediate host for whirling disease), alter channel form and function, and result in other forms of habitat degradation. Improperly placed, shaped, and sized culverts can act as fish barriers on key streams or exacerbate erosion and, in turn, result in head-cutting.

For any given watershed, the overall risks of impacts to aquatic ecosystems due to roads tend to increase with new road construction or reconstruction. Conversely, risks of impacts to aquatic and riparian ecosystems tend to decrease with road obliterations. Road maintenance may result in short-term increases in soil erosion; however, routine road maintenance provides opportunities to stabilize road features and improve road drainage. The location of roads is also an important consideration when minimizing erosion and sedimentation of streams. Roads constructed adjacent to stream channels can potentially restrict channel meander or increase stream slope, causing the stream to down-cut and erode. Roads adjacent to streams can directly increase sedimentation. The relative impacts of roads on aquatic resources are based on the net change between new construction/reconstruction, and road obliteration proposed under each alternative. Through application of standards and guidelines and BMPs, such as installing silt fences or erosion control

waddles adjacent to newly constructed roads to slow and filter storm water runoff, impacts to fisheries and aquatic ecosystems should be minimized.

Small amounts of water are used in road construction and reconstruction, road maintenance, and dust abatement. This water would be obtained from federal and/or private sources. Since this water is connected to a federal action, it is considered a depletion from a major river basin and would require preparation of a BA and coordination and consultation with the USFWS for threatened and endangered species under Section 7 of the ESA. Because of miles of roads, these activities are almost entirely confined to NFS lands. For all alternatives, about 9 acre-feet of water in the San Juan River Basin and 6 acre-feet of water in the Dolores River Basin are used on NFS lands over a 15-year period for road construction and reconstruction, road maintenance, and dust abatement, excluding road-related activities with gas well drilling and completion.

Threatened or Endangered Species

Under all of the alternatives, the impacts related to roads on bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker found in the San Juan River downstream of the planning area would generally be minor except for water depletion concerns. Under all of the alternatives, due to new oil and gas leases in the PLAA, as well as over other activities that require road construction in areas with salinity issues, high road densities, or sensitivity to disturbance, projects in the Dolores River watershed may adversely impact these four, warm-water, downstream endangered species. Under all of the alternatives, the impacts from roads on the lineage greenback cutthroat trout (found only on NFS lands) would generally be minor, given the location of the populations, but some individuals may be adversely affected. However, the impacts related to roads from oil and gas development, timber sales, or other vegetation treatment are speculative. More precise impacts cannot be determined until the location, timing, size, and exact design of the projects are known.

For all alternatives, the impacts to the endangered fish species downstream of the planning area may be adverse due to water used in road construction and reconstruction, road maintenance, and dust abatement. The SJNF and TFRO would coordinate with the USFSW and rely on its recovery programs in these major river basins for guidance with proactive management to minimize effects.

Sensitive Species

Generally, the impacts related to roads may adversely impact specific individuals of the species. Overall, however, these impacts would be minor under all of the alternatives for the populations of the three warm-water species found in the La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo Rivers (roundtail chub, flannelmouth sucker, and bluehead sucker) at the lower elevations of the planning area. Projects that implement the LRMP requiring new road construction in the Dolores or Mancos River drainages (such as oil and gas development) may result in adverse impacts to all three warm-water species. However, under all of the alternatives, the impacts related to road construction in the Dolores or Mancos River drainages on bluehead sucker and flannelmouth sucker would likely be more adverse (due to their more tenuous situations) than for roundtail chub. The exact details, such as specific locations (which are an LRMP implementation question), for these projects are presently unknown; therefore, the impacts are speculative. Under all of the alternatives, due to the locations of streams with conservation populations, roads may adversely impact individuals of Colorado River cutthroat trout (found only on NFS lands). These impacts, however, would be minor for the population of the Colorado River cutthroat trout.

For all alternatives, the impacts to the warm-water sensitive fish species may be adverse due to water used in road construction and reconstruction, road maintenance, and dust abatement. We would work

cooperatively with the CPW to develop proactive management programs to minimize adverse effects to these sensitive fish species.

Management Indicator Species and Common Cold-water Fish

Under all of the alternatives, the potential impacts on brook, brown, cutthroat, and rainbow trout from roads may be similar. The overall impacts would vary from minor to moderate. Alternatives A and D would propose slightly more miles of construction and reconstruction than would Alternatives B and C; therefore, they would result in slightly higher impacts to fishery habitat quality due to sediment production. For all alternatives, the impacts to these cold-water fish species would be minor from water used in road construction and reconstruction, road maintenance, and dust abatement. Under all of the alternatives, due to their widespread distribution and abundance, the viability of these fish populations would not be threatened. The potential impacts to fisheries and aquatic species related to trails would be negligible, relative to the potential impacts related to roads.

Comparison of Alternatives

Overall, the impacts related to roads on fisheries would vary from minor to moderate, depending on the location of the project. Alternatives A and D have the greatest potential for impacts to fisheries and aquatic species (due to the similarity in proposed miles of road construction and reconstruction). Alternatives B and C would have the least potential for impacts (because they would propose slightly fewer miles of road construction and reconstruction). With regard to threatened, endangered, or sensitive species, the impacts in the La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo River systems would be minor. The impacts in the Dolores or Mancos River systems may be more adverse due to the greater number of areas in the Dolores and Mancos River watersheds with salinity issues, as well as high road densities and/or species sensitivity to disturbance. The impacts on fish related to roads would be mainly due to sediment degradation of fish habitat. Use of BMPs and other techniques such as sediment trapping buffers and fences would minimize effects to aquatic ecosystems.

Impacts to Aquatic Ecosystems and Fish Species from Oil and Gas Leasing and Development Decisions

The impacts related to oil and gas leasing and development on water quantity and water quality are discussed in Section 3.6, Water Resources. There are indications that oil and gas resource potential may result in leasing and exploration east of Pagosa Springs (in the San Juan Sag area) on NFS lands, and on the BLM portion (especially in the Disappointment Valley, Big Gypsum Valley, and Dry Creek Basin, and along the Dolores River Canyon) and on the NFS portion (especially in the Glade and McPhee Reservoir areas, and along the Dolores River Canyon) of the Paradox Basin. There are two types of possible gas development (i.e., conventional and GSGP gas) within the Paradox Basin. Exploration could include one to two wildcat wells per year in the San Juan Sag area. For conventional development in the Paradox Basin, four to seven exploratory gas wells per year may be developed on BLM lands for the 15-year period, and five to eight wildcat gas wells per year may be developed on NFS lands for the same period (see Section 3.19, Fluid Minerals). For the GSGP development within the Paradox Basin, exploratory wells are slowly developed for the first seven years, then accelerated development occurs. For BLM lands, two to three exploratory gas wells per year are constructed for the first 7 years, then nine to 24 gas wells per year are developed for the next 8 years. For NFS lands, six to eight wildcat wells are constructed for the first 7 years, then 37 to 68 gas wells per year are developed for the next 8 years.

In total, approximately 8 to 12 acres per year may be disturbed from well pads and roads on BLM public lands from oil and gas development activity for the first 7 years. For the next 8 years, about 36 to 96 acres per year may be disturbed. For all oil and gas development on NFS lands, approximately 24 to 32 acres per year may be disturbed from well pads and roads for the first 7 years. For the following 8 years, about 148 to 272 acres per year may be disturbed. If paying quantities of gas are discovered in the San Juan Sag and Paradox Basin (for both conventional and GSGP gas development), as many as 263 and 611 production wells are projected for BLM lands and NFS lands, respectively.

The potential impacts to aquatic ecosystems and fish species from oil and gas leasing and development would be mainly related to water depletions and some reduced stream flows. This would, subsequently, reduce fishery habitat available for use, increase sediment production, and result in degraded fishery habitat. Other potential effects include salinity and water contamination from petroleum products, drilling mud, and other contaminants. For the San Juan Sag (within the San Juan River Basin), 35 acre-feet of water is projected to be used in well drilling, fracturing, and completion process for unleased mineral estate over the next 15 years for all alternatives.

Substantial quantities of water are projected to be used in the drilling, fracturing, and completion process for both the GSGP and Paradox conventional development (Table 3.5.4). The major river basins affected by the projected development in the PLAA are the Dolores and San Juan River Basins. GSGP gas wells in the Paradox Basin would use approximately 7.9 to 13.1 acre-feet of water per well in the drilling and completion process. This level of water consumption is 6 to 11 times the amount of water used to drill and complete a conventional gas well and 11 to 18 times the amount of water used to drill and complete a CBM gas well. Paradox conventional gas wells would use 3.3 acre-feet of water per well in the drilling and completion process. This level of water use is 2.5 times the amount of water used to drill and complete other conventional wells and five times the amount of water used to drill and complete a CBM well.

Table 3.5.4: Projected Water Used in Well Drilling, Fracturing, and Completion (acre-feet) for Leased and Unleased Gothic Gas Shale Play and Paradox Conventional Gas Wells over a Period of 15 Years for National Forest System and Bureau of Land Management Lands by Alternative

	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
USFS leased and unleased GSGP and Paradox conventional	5,311	5,032	4,556	5,300	832
BLM leased and unleased GSGP and Paradox conventional	4,265	3,726	3,593	4,107	2,480
Total	9,576	8,758	8,149	9,407	3,312

It is assumed that all water associated with GSGP and Paradox conventional gas development would be purchased and trucked into the project area, as the water would not be obtained from water sources on public land. The sources of this private water are unknown, but would occur within the San Juan River and Dolores River Basins. Since this water is connected to a federal action, it is considered a depletion from a major river basin and would require preparation of a BA and coordination and consultation with the USFWS for threatened and endangered species, under Section 7 of the ESA.

Water can also be depleted during gas field production. For GSGP and Paradox conventional activities, small quantities of water are produced or pumped from the gas-producing formation(s) in order to release the pressure on the gas tied-up in the seam and allow it to flow. In some cases as wells are drilled and the formation(s) fractured, groundwater may be connected to surface water streams. With the large number of gas wells proposed in the GSGP and Paradox conventional development (Table 3.5.5 and Table 3.5.6), the amount of produced water removed may reduce some stream flows in stream systems with warm-water sensitive fisheries or tributary to downstream threatened and endangered species and sensitive fishery streams. Because of difficulties in quantifying effects on stream flow, water depleted due to gas field production is not estimated for the GSGP and Paradox conventional production.

Table 3.5.5: Projected Number of Gas Wells and Water Used in Well Drilling, Fracturing, and Completion (acre-feet) for Leased and Unleased Gothic Shale Gas Play and Paradox Conventional Gas Wells over a Period of 15 Years by Major River Basin for National Forest System and Bureau of Land Management Lands under Alternative A

	Future Leases Dolores River Basin	Future Leases San Juan River Basin	Existing Leases Dolores River Basin	Existing Leases San Juan River Basin
USFS				
Number of wells	562	24	101	0
Water used (acre-feet)	4,262	216	832	0
BLM				
Number of wells	229	34	326	25
Water used (acre-feet)	1,490	296	2,256	224
Total of water used (acre-feet)	5,752	512	3,088	224

Table 3.5.6: Projected Number of Gas Wells and Water Used in Well Drilling, Fracturing, and Completion (acre-feet) for Leased and Unleased Gothic Shale Gas Play and Paradox Conventional Gas Wells over a Period of 15 Years by Major River Basin for National Forest System and Bureau of Land Management Lands under Alternative C

	Future Leases Dolores River Basin	Future Leases San Juan River Basin	Existing Leases Dolores River Basin	Existing Leases San Juan River Basin
USFS				
Number of wells	460	20	101	–
Water used (acre-feet)	3,539	185	832	–
BLM				
Number of wells	147	20	326	25
Water used (acre-feet)	928	185	2,256	224
Total of water used (acre-feet)	4,467	370	3,088	224

Decreased stream flows may impact aquatic habitat and fish populations by reducing, or eliminating both the extent and quality of suitable habitat by increasing stream temperatures and, subsequently, reducing dissolved oxygen levels. Such impacts may be more pronounced during periods of natural cyclic flow reductions during fall and winter or during summer months during periods of drought. A loss of stream flow can also reduce a stream’s ability to transport sediment downstream and result in

increased deposition which, in turn, can impact the numbers and diversity of benthic macro invertebrates and, ultimately, aquatic habitat.

Clearing of drill pads and roads and their continued use can expose soil to both wind and water erosion. Given the number of well pads and roads projected in the PLAA, consequential sedimentation of streams and still water bodies has the potential to impact fishery and aquatic resources (Table 3.5.7). These impacts may be more pronounced in the Paradox Basin because of the number of sensitive watersheds with sediment and salinity concerns that may be upstream of warm-water sensitive fisheries or threatened and endangered species (see Table 3.6.3 in Section 3.6, Table I.3 in Volume III, Appendix I, and Map 7 in Volume III, Appendix V). Eroded material may be delivered to streams as fine sediment and deposited in channels or transported downstream. The actual amount of sediment from these land-disturbing activities that reaches stream channels or still water bodies would be a result of numerous factors including the location of roads, number of road/stream crossings, slope steepness and length, amount of exposed soil, type of vegetation in the area, frequency and intensity of rainfall, soil type and the implementation and effectiveness of BMPs. A typical concern with sedimentation is that sediment loads, above background levels, can reduce pool depths, bury stream substrates and spawning gravels, adhere to aquatic insects and the gills of fish, alter channel form and function, and result in other forms of habitat degradation. Where sediment production is high in areas of exposed marine shales, elevated salinity levels, over extended periods of time, may become toxic for aquatic ecosystems and fish species.

Table 3.5.7: Projected Surface Disturbance (in acres) for Leased and Unleased Gothic Shale Gas Play and Paradox Conventional Gas Well Development over a Period of 15 Years for National Forest System and Bureau of Land Management Lands by Alternative

	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
USFS leased and unleased GSGP and Paradox conventional	3,570	3,395	2,770	3,555	530
BLM leased and unleased GSGP and Paradox conventional	3,070	2,688	2,590	2,920	1,780
Total	**6,640**	**6,083**	**5,360**	**6,475**	**2,310**

LRMP direction addresses potential aquatic impacts from surface disturbance. Where gas facilities are developed within the Paradox Basin, soil erosion and sediment deposition, and corresponding potential to impact aquatic and riparian habitat, would be limited by implementing lease stipulations that require avoidance of sensitive, erosion-prone areas and riparian areas by using standards and guidelines and the application of BMPs. Some of these BMPs may include, for example, graveling road surfaces to avoid dust and loss of soil to wind erosion, revegetating or covering any soil stockpiles that would remain for extended periods to avoid significant wind and water erosion, installing slope breaks and silt fences on slopes to slow and filter storm water runoff that might carry exposed soils to surface water drainages, timely reclaiming disturbed areas to minimize erosion after construction of facilities, and avoiding locations having highly erosive soils where possible. Non-productive wells would also be immediately reclaimed. The applicable lease stipulations to protect aquatic ecosystems and fish species are provided in Table 3.5.8.

Table 3.5.8: Lease Stipulations That Pertain to the Aquatic Ecosystem and Fish Species as Applied by Alternative

Fisheries	Alternative A	Alternative B	Alternative C	Alternative D
Perennial streams, water bodies, riparian areas, and fens: Prohibit surface occupancy and surface-disturbing activities within a minimum buffer distance of 325 horizontal feet for all perennial waters. See stipulation for full description of distances where NSO applies.	NSO	NSO	NSO	CSU
Perennial streams, water bodies, riparian areas, and fens: From 325 to 500 horizontal feet from the perennial water body, CSU restrictions would apply. See stipulation for full description of distances where CSU applies.	CSU	CSU	CSU	SLT
Reservoirs and lakes: For reservoirs and lakes 1 acre or larger as measured by the high water mark, NSO would be allowed within 0.25 mile of the high water shoreline.	NSO	NSO	NSO	CSU
Colorado River cutthroat trout (sensitive species): Within 0.25 mile of streams occupied by conservation populations of Colorado River cutthroat trout or streams that have been identified as reintroduction sites for Colorado River cutthroat trout.	NSO	NSO	NSO	CSU
Greenback cutthroat trout (threatened species): Within 0.25 mile of streams occupied by existing populations of greenback cutthroat trout.	NSO	NSO	NSO	NSO
NSO = no surface occupancy; CSU = Controlled surface use; SLT = Standard lease terms.				

Another potential impact to fisheries from the projected gas development and production would be the potential for various chemical leaks and spills. This impact is also addressed in the Water Resources Section of this chapter and is mitigated through the use of BMPs that apply to well drilling operation maintenance and material handling.

In regard to air quality (see Section 3.12), the effects on aquatic ecosystems and fish species would be negligible over the life of the LRMP. The air quality analysis was focused on the entire planning area, not just the PLAA. It is a modeling effort with many assumptions, including a gas development scenario as depicted in the RFD scenario. The potential impacts of nitrogen loading or sulfur dioxide deposition to lakes, streams, and the aquatic ecosystems and fish species would be a very slow and prolonged process. It would be very difficult to detect any measureable effects on aquatic ecosystems well beyond the life of the LRMP.

Comparison of Alternatives

The impacts of oil and gas development to aquatic ecosystems and fisheries vary as a function of the amount of gas development projected under each alternative and of stipulations applied in each alternative. Alternative A, followed by Alternative D, has the greatest amount of development projected. Alternative B has the third largest amount of gas development projected, and Alternative C

has the lowest. The lease stipulations that mitigate impacts to aquatic ecosystems and fish species are generally the same in Alternatives A, B, and C. The stipulations under Alternative D are not as protective. Quantitatively and qualitatively, Alternative A could result in the most impacts to aquatic habitat followed in order by Alternatives D, B and C for water depletion impacts (Table 3.5.4) and water quality effects (Table 3.5.7).

Under the No Leasing Alternative, potential impacts to threatened, endangered, sensitive, and MIS fish species could result from developing existing leases only, which is approximately 635 gas wells and 406 well pads fewer than Alternative A, and generally the other alternatives, and therefore would have the least impact to aquatic ecosystems and fish species.

Threatened or Endangered Species: Bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker found in the San Juan and Dolores Rivers downstream of the planning area are federally listed as endangered species. The impacts from gas leasing and development alternatives in the Paradox Basin are ranked from greatest to least by Alternatives A, D, B, and C. The impacts to these endangered fish species may be minor to adverse downstream of development due mainly to water depletions from gas development and production, some reduced stream flows, and some reduced fishery habitat. Despite large quantities of water used in the drilling, fracturing, and completion of gas wells in the GSGP, much of this private water may be already considered as losses to these major river basins through high evaporative losses during irrigation and other consumptive uses. There would be concerns in the sensitive Hydrologic Unit Code (HUC) 6 watersheds with salinity issues, high road densities, and sensitivity to disturbance (Dolores and Mancos River systems), resulting in higher salt concentrations in streams and increased sediment impacts (see Table 3.6.3 in Section 3.6, Table I.3 in Volume III, Appendix I, and Map 7 in Volume III, Appendix V). The USFS and BLM would coordinate with the USFWS and rely on its recovery programs in these major river basins for guidance with proactive management to minimize effects. If new leases are not made available, there would be no impacts on these endangered fish species because no new impacts would occur from oil and gas development.

The lineage greenback cutthroat trout is found in four streams on NFS lands in the upper portion of the Dolores River Basin outside the GSGP but within the Paradox Basin. Given the NSO stipulation for this trout species under all alternatives, and the location of the populations, the impacts from gas leasing and development for all alternatives could vary from no impact to minor for the greenback cutthroat trout. Impacts related to oil and gas development are generalized as more precise impacts cannot be determined until the location, timing, and exact design of the projects are known.

Sensitive Species: The sensitive fish species that would be potentially impacted by development of the GSGP and Paradox conventional gas wells include roundtail chub, flannelmouth sucker, and bluehead sucker found in the major rivers and streams at the lower elevations of the planning area. The potential impacts from GSGP or Paradox conventional leasing and development alternatives would range from highest in Alternative A, to Alternatives D, B, and C, in descending order, and could result in minor to adverse impacts, depending on the location of the specific downstream populations relative to development. Impacts would be as described for downstream threatened and endangered species and the impact mitigation approaches contained in leasing stipulations, standards, and guidelines, and BMPs would be implemented. The USFS and BLM would work cooperatively with the CPW to develop proactive management programs to minimize adverse effects to these warm-water sensitive fish species.

The Colorado River cutthroat trout is only found in a stream on the far eastern edge of the PLAA, outside the GSGP on NFS lands. This species is also found in streams on NFS lands within the San Juan Sag, which has little development and water usage projected for future leases. Given the NSO

stipulation for this trout species for Alternatives A, B, and C, the CSU stipulation for Alternative D, and the location of conservation populations and habitat, the impacts from gas leasing and development on the Colorado River cutthroat trout under all alternatives could vary from no impact to minor. More precise impacts cannot be determined until the location, timing, and exact design of the projects are known.

Management Indicator Species and Common Cold-water Fish: Generally, the impacts could vary from minor to moderate, depending on the well pad and road location, for brook, brown, cutthroat, and rainbow trout from future lease areas (the BLM and USFS portions of the Paradox Basin and the San Juan Sag). The greatest potential for impacts to cold water trout would occur immediately downstream from areas of gas development. The impacts would be primarily due to water depletions, some reduced stream flows and commensurate reduced fishery habitat available for use, sediment production, and salinity concerns. Alternative A would present the greatest risk to brook, brown, cutthroat, and rainbow trout because it has greatest amount of development relative to the other alternatives. Alternatives D, B, and C would have the next greatest to least amount of impacts to aquatic ecosystems and fisheries. Under all of the alternatives, the viability of common cold water fish would not be threatened due to their widespread distribution and abundance.

Impacts to Aquatic Ecosystems and Fish Species from Mining and Mining Reclamation Decisions

The impacts related to mining and mining reclamation on water quantity and water quality are discussed in Section 3.6, Water Resources. Within the planning area, mining activities may include suction dredging, gravel mining operations, hard-rock mining, uranium and vanadium mining, and recreational gold panning. The impacts of concern to fisheries and aquatic species related to mining or mining reclamation would be mainly due to erosion and sediment impacts (i.e., degraded fishery habitat), saline runoff, heavy metal loading of streams (i.e., toxic levels for aquatic species), and/or altered stream channels and associated fishery habitat.

<u>Threatened or Endangered Species</u>

Generally, the impacts related to mining and mining reclamation would be similar under all of the alternatives and would be minor on bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker found in the San Juan River downstream of the planning area. Under all of the alternatives, due to concerns with salinity issues, high road densities, or sensitivity to disturbance, projects in the Dolores River watershed would have the potential to result in adverse impacts to these four endangered species. Depending on the location of the action, the impacts related to mining or mining reclamation, which may be nearly identical under all of the alternatives, on the lineage greenback cutthroat trout (found only on NFS lands) may vary from no impact to adverse impacts to specific individuals. Overall, however, they would be minor for planning area populations. Since the impacts related to mining are speculative, more precise impacts cannot be determined until the location, timing, size, and exact design of the projects are known. The USFS and BLM would require plans of operation, etc., from the proponents and would incorporate environmental protection requirements from the LRMP, including referenced direction that contain BMPs.

<u>Sensitive Species</u>

Generally, the impacts related to mining and mining reclamation would be similar under all of the alternatives and may adversely impact specific individuals of the species. They may, however, generally be minor for the populations of roundtail chub, flannelmouth sucker, and bluehead sucker found in the La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo Rivers at the lower

elevations of the planning area. Under all of the alternatives, specific mining projects in the Dolores or Mancos River drainages with salinity issues, high road densities, or sensitivity to disturbance could result in adverse impacts to the roundtail chub, flannelmouth sucker, and bluehead sucker. The exact details for these projects are presently unknown if they were to be filed on or applied for; therefore, the impacts continue to be speculative. Depending on the location of the action, the impacts related to mining or mining reclamation Colorado River cutthroat trout (found only on NFS lands), if projects were proposed and approved, may vary from no impact to adverse impacts to specific individuals. Overall, however, they would be minor because of the location of the conservation populations.

Management Indicator Species and Common Cold-water Fish

Under all of the alternatives, potential adverse impacts related to mining or mining reclamation on brook, brown, cutthroat, and rainbow trout and associated aquatic species are expected to be minor and relatively localized. Under all of the alternatives, the potential for mineral exploration and development (for uranium in particular) would be similar; therefore, all of the alternatives could result in similar adverse impacts to aquatic ecosystems. Mining reclamation could benefit some trout habitat and populations (by reducing the amount of heavy metal loading into stream systems).

Comparison of Alternatives

The impacts related to mining and mine reclamation are not expected to vary between the alternatives because they may be similar project applications and therefore similar acres of disturbance under all of the alternatives. Overall, the impacts to fisheries would vary from no impact to adverse impacts (depending on the location of the mining or mine reclamation project). To minimize impacts, the USFS and BLM would only approve plans of operation that control mining impacts by implementing the requirements of the LRMP. With regard to downstream endangered and warm-water sensitive species, the impacts in the La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo River drainages may be minor. The impacts in the Dolores or Mancos River systems may be more adverse (due to the greater number of areas with salinity issues, high road densities, and sensitivity to disturbance). Depending on the location of the action, the impacts related to mining or mining reclamation on lineage greenback cutthroat trout and Colorado River cutthroat trout may vary from no impact to adverse impacts to specific individuals in localized areas. Overall, however, they would be minor for planning area populations. With regard to the common cold-water trout, the impacts would be minor, with localized adverse impacts. The impacts related to mining and mine reclamation are mainly due to sediment impacts on habitat, saline runoff or heavy metal loading of streams, or altered fishery habitat, which would be controlled through project plans of operation that incorporate LRMP requirements including BMPs.

Impacts to Aquatic Ecosystems and Fish Species from Vegetation Management Decisions

As described in Section 3.6, Water Resources, the greatest impacts related to timber sales on fisheries may be from road construction or reconstruction, as well as from the subsequent sedimentation and degraded fishery habitat. The impacts from mechanical fuels reductions, rangeland treatments, and wildfire and additional timber sales on the magnitude, timing, and duration of stream flow, and on water quality, are described in Section 3.6, Water Resources. Where mechanical fuels treatments use hydro-mowers and roller choppers, mulch would also be generated on the soil surface, which would reduce overland flow and erosion. Other vegetation management (including utility corridors and ski area modifications and expansions) may result in similar impacts as those presented in Section 3.6, Water Resources.

Other vegetation treatments (including prescribed burns) may result in considerably less severe impacts compared to wildfire. Under these treatments the location and severity of the fire are controlled to a greater extent; therefore, more ground cover would remain and the erosion potential would be reduced. Sediment trapping buffers would generally remain around stream channels in order to reduce the amount of sediment delivered to the stream. Rarely do entire watersheds burn as a result of prescribed burns or wildfires managed for multiple resource benefits. These treatments are beneficial because they can reduce the impacts of changes in water yield and peak flows due to conditions such as drought. Furthermore, the careful and judicious use of prescribed burns may help to reduce the risk of uncontrolled wildfires that may otherwise burn through and severely damage watersheds and riparian areas, increase erosion and sedimentation, and degrade large segments of fishery habitat.

Beyond the effects of sediment from vegetation management, fisheries and aquatic species can be impacted by a reduction of streamside vegetation. Due to a reduction in streamside vegetation, average annual and average daily stream temperatures can increase by reducing shade and decreasing the recruitment of large woody debris in streams. Overhanging vegetation provides cover for fish and helps cool stream temperatures. Large woody debris recruitment is important because it dissipates erosive stream energy, regulates sediment movement downstream, provides nutrients, and creates pools important to aquatic species.

Threatened or Endangered Species

Generally, in terms of impacts to fisheries related to vegetation management (timber harvesting, mechanical fuels reductions, rangeland treatments, prescribed fires, etc.), impacts under all of the alternatives would be similar. This is because all of the alternatives are nearly the same (only 1,800 acres separate Alternative D, which would propose the greatest levels of vegetative treatment, and Alternative C, which would propose the least amount of treatment). Vegetation management would result in minor adverse impacts to bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker in the lower San Juan and Dolores Rivers. The impacts would be mainly due to upstream sediment and stream temperature impacts on downstream fishery habitat. Impacts to the lineage greenback cutthroat trout (found only on NFS lands) under all alternatives from vegetative management may adversely impact specific individuals but would generally be minor.

Sensitive Species

Under all alternatives, the impacts related to vegetation management may adversely impact specific individuals of the species. However, they would be minor for the population of roundtail chub, flannelmouth sucker, bluehead sucker, or Colorado River cutthroat trout. This is because all of the alternatives would be similar (only 1,800 acres separate Alternative D, which proposes the greatest levels of vegetative treatment, and Alternative C, which proposes the least amount of treatment). The impacts are driven by sediment and stream temperature influences on fishery habitat quality.

Management Indicator Species and Common Cold-water Fish

Under all of the alternatives, aquatic ecosystems would be protected. However, the residual risk of adverse consequences to these trout species would increase with higher harvesting and treatment levels. The potential for impacts to brook, brown, cutthroat, and rainbow trout would be proportional to the harvesting or treatment acres per year. Alternative D proposes more treatment acres than would any of the other alternatives; therefore, it would result in the highest risk of potential adverse impacts to aquatic species related to vegetation management. Under all of the alternatives, the impacts related to vegetation management on these trout species would vary from minor to moderate. Risk

and consequence would depend on a variety of factors, including the type of harvesting or treatment, as well as on the location of such treatments relative to stream system. Due to their widespread distribution and abundance, the viability of these fish populations would not be threatened under any of the alternatives.

Comparison of Alternatives

Overall, the impacts related to vegetation management (timber harvesting, mechanical fuels reductions, rangeland treatments, prescribed fires, etc.) on fisheries would be minor, with some localized impacts. Alternative D would result in a greater potential for impacts to fisheries and aquatic habitat because it proposes the largest amount of vegetation treatment acres than would any of the other alternatives. The impacts to fisheries would be mainly due to sediment and stream temperature influences. Use of standards and guidelines, BMPs, and standards and guidelines would minimize the effects to aquatic ecosystems and fisheries.

Impacts to Aquatic Ecosystems and Fish Species from Fishery, Watershed, and Riparian Area Improvement Project Decisions

The impacts related to fishery, watershed, and riparian area improvement projects on watershed health, stream channel function, and water quality are summarized in Section 3.6, Water Resources. These improvement projects can result in positive outcomes for both fisheries and recreational anglers. Over the last 25 years, a variety of fish habitat improvement projects (including stream-bank stabilizations, pool forming structure placements, spawning habitat enhancement, fish barriers, and culvert replacements) have been implemented throughout the planning area. In addition, the SJNF has assisted CPW in conserving and reintroducing genetically pure, wild populations of Colorado River cutthroat trout in selected streams on NFS lands (especially in the Hermosa Creek watershed). On occasion, and after project-level analysis and public involvement, some desired non-native fish populations have been (and are being) removed in order to favor the establishment of native fish populations (including Colorado River cutthroat trout). In these instances, the SJNF, TRFO, and CPW would continue to work together in order to achieve all environmental objectives. All of the alternatives would have fishery, watershed, and riparian improvement project objectives, which include fish habitat improvement, erosion control, stream restoration, riparian/lake/fen treatments, and road decommissioning.

Threatened or Endangered Species

Under all of the alternatives, improvement projects would result in no impacts to the four endangered trout species downstream of the planning area (bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker) because there would be no water depletion and no suitable habitat directly impacted. Under all alternatives, due to the locations of the existing populations on the SJNF and TRFO, these improvement projects would result in no impacts, or beneficial impacts, to the lineage greenback cutthroat trout (found only on NFS lands).

Sensitive Species

Similar to the downstream endangered species, and in relation to all of the alternatives, improvement projects would result in no impacts to the three warm-water species (roundtail chub, flannelmouth sucker, and bluehead sucker) found in the Dolores, Mancos, La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo Rivers. These species would have no directly affected suitable habitat, nor would there be any water depletions. Under all of the alternatives, due to the locations of specific

streams with conservation populations and reintroduction efforts, these improvement projects would result in no impacts, or result in beneficial impacts, to Colorado River cutthroat trout.

Management Indicator Species and Common Cold-water Fish

All of the alternatives have annual fishery, watershed, and riparian improvement objectives. Alternative C proposes the greatest number of total treatments per year; therefore, it would result in the greatest overall benefit to brook, brown, cutthroat, and rainbow trout. Occasionally, where a reintroduction project for Colorado River cutthroat trout occurs, these common cold water trout species may be removed from certain drainages. Under all of the alternatives, due to their widespread distribution and abundance, the viability of these fish populations would not be threatened.

Comparison of Alternatives

Under all of the alternatives, with regard to downstream endangered species or warm-water sensitive species, improvement projects would result in no impacts. This is because there would be no water depletion and no suitable habitat would be directly impacted. With regard to lineage greenback cutthroat trout, Colorado River cutthroat trout, and MIS/common cold-water trout, Alternative C would result in the greatest benefits from improvement projects, followed by Alternatives D, B, and A (due to the amount of stream miles or acres impacted or structures proposed).

Cumulative Impacts

Actions taken to implement any of the alternatives, along with past, present, and foreseeable future activities undertaken within the planning area (or other nearby jurisdictions, including local, state, Native American tribal, and other federal actions, as well as private) could result cumulative impacts. The cumulative impacts analysis covers the implementation timeframe of the approved LRMP (10–15 years) and includes lands (within or downstream of the planning area) contained in all 5th-level HUC boundaries. An example would be watersheds roughly the size of the Hermosa Creek or Piedra River watersheds. A synopsis of key cumulative impacts on water quantity, water quality, and water-dependent ecosystems is provided in the Water Resources Section of this chapter and is not repeated here.

Four tables above are based on the scenario in the 2009 Addendum to the RFD (BLM 2009a; BLM and USFS 2010) and the projections for gas development for all alternatives and quantify the factors that would lead to cumulative effects to fisheries and aquatic resources in the GSGP and Paradox conventional gas development. Table 3.5.4 displays the projected acre-feet of water that would be used over 15 years for both future and existing leases on both NFS and BLM public lands in the PLAA for all alternatives. Table 3.5.5 displays the projected number of gas wells and acre-feet of water that would be used over 15 years by major river basin for both future and existing leases in the Paradox Basin on both NFS and BLM public lands for Alternative A, which has the greatest gas development of all alternatives. Table 3.5.6 displays the projected number of gas wells and acre-feet of water that would be used over 15 years by major river basin for both future and existing leases in the Paradox Basin on both NFS and BLM public lands for Alternative C, which has the least projected gas development of all alternatives. Table 3.5.7 describes the surface disturbance (in acres) on both future and existing leases in the PLAA on NFS and BLM public lands for all alternatives. These tables should be examined in concert with Table 3.6.3 in Section 3.6, Table I-3 in Volume III, Appendix I, and Map 7 in Volume III, Appendix V for a full view of the factors that would lead to cumulative effects to fisheries and aquatic resources in the GSGP and Paradox conventional gas development.

Threatened or Endangered Species

Past local and regional water development activities and their cumulative effects have had a dominating impact on bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker (federally endangered species) found in the San Juan and Dolores Rivers downstream of the planning area, although these four species have also been affected by non-native species and other factors. The lineage greenback cutthroat trout, found in the upper portions of the Dolores River system within the planning area, has been federally listed as a threatened species primarily due to the introduction of non-native fish species. Water development activities, over-fishing, and water quality factors have also impacted the greenback cutthroat trout. Under all of the alternatives, the primary adverse cumulative impacts on these species would occur as the result of activities that lead to further water depletions and some reduced stream flows, as well as to subsequent reduced or eliminated fishery habitat, increased stream temperatures, and reduced dissolved oxygen levels. These activities would be mainly due to water use and development projects or gas development and production from current and private mineral estate leases both within or outside the planning area.

Gas development on private and state mineral estate development may add an additional 810 wells to those projected for development on federal mineral estate in the PLAA. These private and state well numbers equate to 6,540 acre-feet and 166 acre-feet of water used for drilling, fracturing, and completion for the GSGP gas development and Paradox conventional gas development, respectively. For the San Juan Sag (within the San Juan River Basin), existing leases on NFS lands are estimated to have used 7 acre-feet for well drilling and completion. Existing leases for the San Juan Basin CBM and conventional gas wells are estimated to have used 160 and 14 acre-feet of water, respectively, for BLM lands, and 487 and 42 acre-feet of water, respectively, for NFS lands. Private and state mineral estate development may use an additional 722 acre-feet of water for CBM gas wells in the San Juan Basin. The water usage estimates for the above San Juan Basin CBM gas wells (all ownerships) also includes gas production–induced depletions of river and stream flow.

Water is produced in conjunction with the production of CBM gas in the NSJB. Within the basin in Colorado there are concerns that the removal of water from the tributary Fruitland-Pictured Cliffs aquifer may result in stream depletions that impact downstream water users and fisheries. These concerns have prompted four studies spanning 2000 to 2009, which quantify groundwater–surface water impacts and their interactions: Applied Hydrology Associates, Inc., 2000; Cox et al. 2001; Norwest Corporation 2009; S.S. Papadopoulos and Associates Inc. 2006).

The 3M model (Applied Hydrology Associates 2000) simulated the primary streams that cross the Fruitland-Pictured Cliffs aquifer outcrop as receiving discharge water from the Fruitland-Pictured Cliffs aquifer. Estimated total discharge to the rivers crossing the outcrop in Colorado—which includes the Animas, Florida, Los Pinos, Piedra, and San Juan Rivers—were estimated to equal approximately 200 acre-feet per year. CBM development could deplete all or some portion of this total.

The Cox et al. (2001) study estimated CBM development depletions from the Animas, Florida, and Los Pinos Rivers. The model first simulated pre-CBM development discharge from the Fruitland-Pictured Cliffs aquifer into the three rivers as approximately145 acre-feet per year. The authors then calculated that the depletion to the three rivers due to CBM water production projected to 2005 would be up to 95 to 100 acre-feet per year. Data did not permit a model to be constructed to evaluate depletion from the Piedra River and Stollsteimer Creek, but projection of results from the area west were used to provide an estimate of 15 to 60 acre-feet per year of depletion from the Piedra-Stollsteimer system by 2050.

According to the S.S. Papadopoulos and Associates (2006) modeling, the riverine depletion as of August 2005 from the CBM wells producing within the NSJB in Colorado was modeled to be about 155 acre-feet per year. This quantity does not differ greatly from the above depletions calculated in the Cox et al. (2001) study for the Animas, Florida, and Los Pinos Rivers. Stated differently, riverine depletions are approximately 4% to 5% of CBM well water produced. The current CBM water production rate from wells operating in the San Juan Basin in Colorado is approximately 3,000 acre-feet per year.

The Norwest Corporation (2009) report applied a more conceptually complex treatment to the various layers of the Fruitland and Pictured Cliff Sandstone formations, while also incorporating 12 perennial streams that have outcrop contact. The study found that in 2007 discharges to surrounding streams were approximately 100 acre-feet per year, which is consistent with the values from the Applied Hydrology Associates, Cox et al., and S.S. Papadopoulos and Associates studies.

To evaluate future depletions, S.S. Papadopoulos and Associates projected further development of CBM resources beyond 2005 based on information provided in well spacing orders for the Fruitland Formation on the selected alternative for the FEIS for the NSJB (USFS and BLM 2006) and on the basis of information provided by Colorado Oil and Gas Conservation Commission (COGCC) personnel. COGCC spacing orders included 80-acre infill development within portions of the Southern Ute Indian Reservation. Two related scenarios were modeled: in the first scenario, all potential future wells were included in the analysis, for a total of 1,516 wells; in the second scenario, wells within a 1.5-mile buffer along the outcrop were omitted. This second scenario recognizes current COGCC prohibitions on drilling within 1.5 miles of the outcrop; under it, 1,155 future wells were installed. Using these assumptions, depletion curves for currently operating wells and under both buffered and unbuffered future well scenarios were determined. These curves indicate that the depletion rate for existing wells would peak in about 2020 at 164 acre-feet per year and that by 2070 depletions would drop below 100 acre-feet per year. Under the buffered future well scenario (i.e., no wells within 1.5 miles of the outcrop), depletions would peak in approximately 2035 at 171 acre-feet per year and would drop below 100 acre-feet per year by 2150. These depletion estimates are relatively low compared to flows in the rivers. The combined base flows for the Animas, Florida and Pine Rivers average nearly 200,000 acre-feet per year (Cox et al. 2001).

The RFD scenario for CBM in the NSJB includes 450 wells to be developed at 80-acre spacing on existing leases. Relying on the above study parameters, to estimate the effects of the RFD, the USFS and BLM assumed 50 barrels/day of produced water per well, or 2 acre-feet/well/year, depletions are approximately 4% of water produced, and that approximately 40% of projected development would occur on federal mineral estate. Consequently on BLM lands for infill CBM development and production, a total of about 103 acre-feet of water would be needed for well drilling and completion and water depletion from intercepted groundwater potentially bound for streams and river over the next 15 years. On NFS lands, a total of approximately 241 acre-feet of water would be needed for well drilling and completion and water depletion from intercepted groundwater potentially bound for streams and rivers over the next 15 years, due to infill CBM development and production. Private and state mineral estate development may use an additional 516 acre-feet of water over the next 15 years for infill CBM development and production.

Future development in the NSJB would occur on existing oil and gas leases, most of which have already been developed. The decision as to whether the existing lease can be developed is a function of project-level decision-making and subject to the rights granted by the associated leases. Consequently, federal lease development in the NSJB is not considered a direct effect of the LRMP decisions, but is considered an indirect impact and addressed in cumulative effects analysis.

Due to heightened concerns about sediment and salinity inputs and subsequent downstream impacts to fishery habitat quality, ground-disturbing activities (including new road construction and well pads) in the Dolores River watershed may also adversely impact the four endangered species. Stipulations and BMPs for oil and gas development, as described previously and in Section 3.6, Water Resources, and 3.2, Terrestrial Ecosystems should reduce the potential for measurable sedimentation. Since the exact details for these projects and activities are presently unknown, the impacts continue to be speculative. In addition, water used in road construction and reconstruction, road maintenance, and dust abatement may also impact these threatened or endangered species. Preparation of a BA and coordination and consultation with the USFWS is frequently required for many project-level activities within the planning area and would always be required for projects and activities with proposed water depletions. This consultation would result in an outcome that serves to protect the species as required by Section 7 of ESA.

Sensitive Species

As the result of past local and regional cumulative impacts, including the introduction of non-native species, roundtail chub, flannelmouth sucker, and bluehead sucker are USFS and BLM sensitive species. Under all of the alternatives, the primary adverse cumulative impacts on these three warm-water species found in the Dolores, Mancos, La Plata, Animas, Florida, Los Pinos, Piedra, San Juan, and Navajo Rivers (along with some major tributaries), similar to those described for the threatened or endangered fish species above, may occur as the result of activities that lead to additional water depletions and reduced stream flows (i.e., reduced or eliminated fishery habitat that is available for use). These activities would be mainly related to water use and development projects, or to gas development from current and projected new leases on or off the planning area, again as described for threatened or endangered fish species above. Due to heightened concerns about sediment and salinity inputs and downstream impacts on fishery habitat quality, ground-disturbing activities (including new road construction and well pads) in the Dolores or Mancos River watersheds may also adversely impact the three native, warm-water species. The bluehead sucker and flannelmouth sucker appear to be more at risk than the roundtail chub under all of the alternatives; therefore, activities on or off the planning area could contribute to adverse impacts. However, since the exact details for these projects and activities in the Dolores or Mancos River watersheds are presently unknown, the impacts continue to be speculative.

As the result of introductions of non-native fish species and past local and regional cumulative impacts, the Colorado River cutthroat trout is a USFS and BLM sensitive species. Like the other sensitive species, the primary adverse cumulative impacts, under all of the alternatives, would occur as a result of activities that lead to further water depletions and reduced stream flows (i.e., reduced or eliminated fishery habitat for use). Depending on the location of ground-disturbing activities, the cumulative impacts of sedimentation may range from no impact to adverse for certain stretches of stream habitat and individual fish. In order to help avoid federal listing, the SJNF would focus the majority of its fishery habitat improvement efforts toward the recovery of the Colorado River cutthroat trout.

Management Indicator Species and Common Cold Water Fish

The cumulative impacts related to land management activities resulting in water depletions, stream flow reductions, fishery habitat elimination, water temperature increases, sedimentation additions, or fishery habitat degradation in relation to brook, brown, cutthroat, and rainbow trout would be confined to specific stretches of stream habitat and/or localized populations. Due to their widespread distribution and abundance, their viability would not be threatened under any of the alternatives.

Therefore, no alternative is expected to result in substantial cumulative impacts to any common cold water trout species.

3.6 Water Resources

3.6.1 Introduction

In 1891, public concern regarding the issue of having adequate supplies of clean water led to the establishment of federally protected forest reserves in the United States. The importance of water protection was evident in the wording of the Organic Act of 1897, the legislation that founded the USFS, which stated that “no public forest reservation shall be established, except to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flows.”

The protection of water on BLM-administered lands is also emphasized in several acts, most notably FLPMA of 1976, which declares that public lands are to be managed, among other things, for the protection of water and water-related resources. Today, public lands, especially NFS lands, are a large and important source of clean water for this nation. Watersheds throughout the planning area, as administered by the SJNF and TRFO, provide a multitude of benefits, including for aquatic and riparian habitat, municipal water supplies, flood reduction, low-flow augmentation, recreation opportunities, and a continuous supply of clean water for many additional uses.

Water quality within the planning area is typically good (Colorado Department of Public Health and Environment [CDPHE] 2012). In the few water bodies having water quality problems, mercury, heavy metals, sediment, and salinity are common pollutants. In some places, mine-related heavy metals pollution is being cleaned up as a result of the aggressive abandoned mine reclamation program being conducted within the planning area.

Development and depletion of groundwater resources are emerging issues on the SJNF and TRFO, especially in relation to fluid minerals extraction and private land development. Factors such as high road densities, poor road locations, and inadequate road design/maintenance have caused water quality, floodplain, and channel morphology changes in some watersheds.

Over the past decade, drought has also impacted the planning area. The prolonged drought has resulted in lower water tables in some areas, which, in turn, has resulted in reduced water flow in streams, springs, and seeps. Dry upland conditions have increased grazing pressure on riparian areas. The drought-related increase of large wildfires has impacted many watersheds by resulting in increased flooding, erosion, sedimentation, and damage to private property adjacent to, or near, the boundaries of the planning area. Large and small proposals for new water development projects have also increased, in part, as a result of long-term drought. Accommodating increasing public needs for water while, at the same time, protecting aquatic ecosystems may be one of the biggest challenges for the management of public lands over the next few decades.

Legal and Administrative Framework

Laws

- **The Organic Administration Act of June 4, 1897, as amended:** This act contains the initial, basic authority of watershed management on NFS lands. The purpose for the establishment of national forests, as stated in this act, includes securing favorable conditions of water flows.

- **The Multiple-Use Sustained- Yield Act of 1960:** Under this act, "National forests are established and shall be used for outdoor recreation, range, timber, watershed, and wildlife and fish purposes." The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple uses and sustained yield, without impairment of the productivity of the land.
- **The Federal Water Pollution Control Act of July 9, 1956, as amended:** The intent of this act is to enhance the quality and value of the water resource, and to establish a national policy for the prevention, control, and abatement of water pollution. The act was amended by the Federal Water Pollution Control Act/Amendments of 1961, the Water Quality Act of 1965, the Clean Water Restoration Act of 1966, the Water Quality Improvement Act of 1970, NEPA of 1969, the Federal Water Pollution Act of 1969, the Federal Water Pollution Control Act Amendments of 1972, and the Clean Water Act of 1977.
- **The National Environmental Policy Act of January 1, 1970:** This act requires an environmental assessment (EA), including an evaluation of impacts on water resources, for all major federal actions.
- **The Colorado River Basin Salinity Control Act of June 24, 1974:** This act directs the USDI to undertake research and development projects in order to identify methods designed to improve the water quality of the Colorado River.
- **The National Forest Management Act of 1976:** This act substantially amends the Forest and Rangeland Renewable Resources Planning Act of 1974. This act strengthens the references pertaining to suitability and compatibility of land areas; stresses the maintenance of productivity, as well as the need to protect and improve the quality, of soil and water resources; and seeks to avoid the permanent impairment of the productive capability of the land.
- **The Federal Land Policy and Management Act of October 21, 1976:** This act declares that "the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values." It also states, "Terms and conditions must minimize damage to scenic and aesthetic values and fish and wildlife habitat and otherwise protect the environment."
- **The Clean Water Act of 1977:** This act amends the Federal Water Pollution Control Act of 1972. Section 313 of the act stresses that federal agencies must comply with federal, state, and local substantive and procedural requirements related to the control and abatement of pollution to the same extent as required of non-governmental entities. Section 404 of the Clean Water Act regulates the discharge of dredged, excavated, and/or filled material in wetlands, streams, rivers, and other U.S. waters. (The U.S. Army Corps of Engineers is the federal agency authorized to issue Section 404 permits for certain activities conducted in wetlands or other waters of the U.S.) Activities that may be exempt from Section 404 permits, or that are covered under the general permit, are identified in the legislation (include normal silviculture, forest roads using BMPs, and stream-bank erosion control).
- **The Surface Mining and Control and Reclamation Act of August 3, 1977:** This act may require the BLM to make determinations of "probable hydrologic consequences" in relation to mining and reclamation activities.

Executive Orders

- **EO 11288:** This requires that federal agencies develop pollution-abatement plans and preventative measures for the discharge of hazardous waste into waters.

- **EO 11752:** This mandates that federal agencies provide national leadership in order to protect and enhance the quality of air, water, and land resources through compliance with applicable federal, state, interstate, and local pollution standards.
- **EO 11988:** This requires that federal agencies provide leadership and take action to a) minimize adverse impacts associated with the occupancy and modification of floodplains and reduce risks of flood loss; b) minimize impacts of floods on human safety, health, and welfare; and c) restore and preserve the natural and beneficial values served by floodplains.
- **EO 11990:** This requires federal agencies take action in order to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

Regulations and Policies

- **FSM 2500 and FSH 2500:** These consolidate USFS regulation, policy, and direction regarding watershed management. These documents also stipulate limitations of resource use in order to protect watershed conditions.

Other Agreements

- **MOU between the State of Colorado Department of Natural Resources, the State of Colorado Water Conservation Board, and the BLM, 2011:** This MOU provides a formal cooperative framework between the State of Colorado and the BLM in relation to water management on BLM-administered lands in Colorado.
- **MOU between the State of Colorado Department of Natural Resources and USFS, 2009:** This MOU provides a formal cooperative framework between the State of Colorado and the USFS in relation to water management on NFS lands in Colorado.

3.6.2 Affected Environment

Existing Conditions and Trends

Aquatic Resources

The SJNF and TRFO are located within the upper Colorado River Basin. The principal rivers that drain these lands are the Dolores, Mancos, La Plata, Animas, Florida, Los Pinos, Piedra, and San Juan Rivers. All of these river systems drain into the Colorado River. In general, the headwaters of these rivers originate in the higher-elevation igneous or metamorphic rocks of the southern Rocky Mountains. Upon leaving the mountainous terrain, the rivers often create canyons and valleys of variable size as they flow through the sedimentary rocks of the Colorado Plateau, which is located to the south and west of the mountains.

The higher-elevation headwater areas receive the bulk of annual precipitation as snow, and runoff is snowmelt dominated. The point of greatest measured precipitation within the planning area (Wolf Creek Pass, at an elevation of 9,440 feet) averages 40.85 inches per year and this site averages 352 inches of snow. The point of lowest measured precipitation (Uravan, at an elevation of 5,020 feet) averages 12.5 inches per year and this site averages 9.5 inches of snow (National Oceanic and Atmospheric Administration 2005). As with most of the rivers in the arid West, the mountain headwaters are critical for producing the majority of discharge for all the principal rivers originating within the planning area.

There are approximately 1,960 miles of perennial streams within the planning area and approximately 3,122 mapped lakes and reservoirs. Only 1.6% of the lakes and reservoirs are greater than 10 acres. The largest natural lake is Emerald Lake (approximately 284 acres), which is located within the Weminuche wilderness area. The largest reservoir is McPhee Reservoir (approximately 4,328 acres), which is on the Dolores River.

Within the planning area, water quality varies across the landscape. In general, the water quality of most forested watersheds is good. Table 3.6.1 summarizes the water bodies within the planning area that have been recognized by the State of Colorado as having water quality impairment problems.

Table 3.6.1: Water Bodies Classified as Water Quality Impaired

Water Body ID No.	Segment Description	Portion	Clean Water Act Section 303(d) Impairment	Agency
COSJAF03c	Arrastra Gulch including all lakes, tributaries, and wetlands from the source to the confluence with the Animas River	All	Cadmium, zinc	BLM
COSJAF04a	Mainstem of the Animas River from a point immediately above the confluence with Mineral Creek to a point immediately above the confluence with Deer Park Creek	All	Aluminum	BLM
COSJAF05a	Mainstem of the Animas River, including wetlands, from Bakers Bridge to the Southern Ute Indian Reservation boundary	All	Manganese	BLM/USFS
COSJDO04b	McPhee Reservoir and Summit Reservoir	McPhee Reservoir	Aquatic life use (mercury fish tissue)	BLM/USFS
COSJLP01	Mainstem of the La Plata River, from the source to the Hay Gulch diversion south of Hesperus	All	Silver	USFS
COSJLP03a	All tributaries to the La Plata River from Hay Gulch to the Southern Ute Indian Reservation boundary	Cherry Creek	Iron	BLM/USFS
COSJLP04a	Mancos River and tributaries above U.S. Highway 160	E. Mancos River	Copper, dissolved oxygen, manganese	USFS
COSJLP04a	Mancos River and tributaries above U.S. Highway 160	Mancos River	Dissolved oxygen	USFS
COSJLP07a	Mainstem of McElmo Creek from the source to the Colorado/Utah border; mainstem of Yellow Jacket Creek from the source to the confluence with McElmo Creek	McElmo Creek	Iron, E. coli	BLM
COSJLP08a	Tributaries to McElmo Creek	Mud Creek	Selenium	BLM
COSJLP08a	Tributaries to McElmo Creek	Trail Canyon	Iron	BLM

Water Body ID No.	Segment Description	Portion	Clean Water Act Section 303(d) Impairment	Agency
COSJLP11	Narraguinnep, Puett, and Totten Reservoir	Narraguinnep Reservoir, Totten Reservoir	Aquatic life use (mercury fish tissue)	BLM/USFS
COSJPN03	Vallecito Reservoir	Vallecito Reservoir	Aquatic life use (mercury fish tissue)	USFS
COSJSJ06a	San Juan River from Fourmile Creek to Southern Ute Indian Reservation; Mill Creek from source to San Juan River; Echo Canyon Reservoir	Echo Canyon Reservoir	Aquatic life use (mercury fish tissue), dissolved oxygen	USFS
Source: CDPHE (2012).				

Some rangelands in the western portions of the planning area have large areas of exposed marine-derived Lewis and Mancos Shale. In these watersheds, salinity and the delivery of salts to the Colorado River is of national concern. Over the past decade, the BLM has focused a great deal of effort on inventorying, monitoring, and designing erosion control measures that reduce the salt transport to the Colorado River. Map 7 (Volume III, Appendix V) shows the surface locations of the Lewis and Mancos Shale formations. The highest priorities for future salinity reduction work would occur in the watersheds where these formations are present over large areas (Appendix I).

Groundwater

There are four major regional aquifers within the planning area, all located primarily in sedimentary rocks of the Colorado Plateau. Local aquifers also exist and can be found in alluvium along major rivers, as well as in volcanic or fractured crystalline rocks. These aquifers have formed as a result of long-term irrigation practices. Table 3.6.2 summarizes the aquifers and their characteristics.

Table 3.6.2: San Juan National Forest and Tres Rios Field Office Regional and Local Aquifers

Aquifer	Characteristics	Water Quality
Uinta-Animas	Important regional aquifer of the San Juan Structural Basin. Locally, it is found within the Nacimiento and Animas formations and is discontinuous with very slow recharge rates.	Fresh to saline. Fresh water usually located close to recharge areas.[1]
Mesa Verde	Aquifer of the San Juan Basin that is confined by the Mancos Shale. Primary recharge is from higher-elevation areas in north and central New Mexico.[1]	Highly variable.
Coconino-DeChelly	Located in the north and central portions of the planning area.[1]	No detailed water quality data are available.
Dakota-Glen Canyon	Located within several formations, including the Dakota and Morrison formations.[1]	Locally, good quality water may be present where it is close to the surface. Where it is located at great depths, highly dissolved solids limit its potential use.[1]
Fruitland-Pictured Cliffs	Aquifer of the San Juan Basin. Recharge areas exist within the planning area in La Plata and Archuleta Counties.[2, 3]	Water quality varies from good (in recharge areas) to highly saline (near the San Juan River in New Mexico).[2,3]

Aquifer	Characteristics	Water Quality
Florida Mesa	Local aquifer located in southeast La Plata County. Recharge is from historic and current irrigation.	No detailed water quality data are available.
Major Alluvial Aquifers	Largest quaternary alluvial aquifers are located along the La Plata, Animas, Florida, and Los Pinos Rivers. Most wells completed in these aquifers are less than 170 feet.[4]	Water quality is typically good, but highly variable. Headwater aquifers of the Animas and La Plata Rivers contain high concentrations of heavy metals and are acidic.[4]
[1] Robson and Banta (1995). Ground Water Atlas of the United States. [2] BLM and USFS (2006). Northern San Juan Basin Project. [3] Cox et al. (2001). Ground Water-Surface Water Interactions between Fruitland Coalbed Methane Development and Rivers. [4] Topper et al. (2003). Ground Water Atlas of Colorado.		

In the PLAA, the GSGP is a lithologic unit within the Paradox Formation, which is part of the Pennsylvanian age Hermosa Group. The Paradox Formation was created through repeated marine flooding and desiccation, and consists of limestone, dolostone, black shale, anhydrite, halite, and other salts (USGS 1992). Groundwater resources in the Paradox Basin consist of two bedrock aquifers: an upper Mesozoic sandstone aquifer system and a lower Paleozoic carbonate aquifer system, as well as shallow groundwater resources located in the quaternary alluvium (Topper et al. 2003). Additionally, the Paradox Basin contains many developed and undeveloped seeps and springs. The salts of the Paradox Formation serve as a confining layer separating the upper Mesozoic and the Paleozoic aquifer systems (USGS 1983a, 1983b). The water of the Paradox Formation is brinish or saline with chloride concentrations ranging from 62,440 to 115,400 mg/L, and total dissolved solids ranging from 6,730 to 381,436 mg/L (USGS 1983a, 1983b). The Paradox Formation produces no usable water (USGS 1983a, 1983b). The current State of Colorado and EPA secondary maximum contaminant levels for chloride and total dissolved solids in public drinking water are 250 mg/L and 500 mg/L, respectively (5 Code of Colorado Regulations 1003-1; 40 CFR 143.2).

In the Paradox Basin, groundwater wells for domestic and municipal use are placed in quaternary alluvium or the shallow Mesozoic sandstone aquifers. Average municipal and domestic well depth is 179 feet, and 90% of wells are completed to depths shallower than 350 feet (Topper et al. 2003). Existing gas wells in the area have an average depth of 4,400 feet, oil wells average approximately 1,000 feet deep.

Human Activities and Management Activities

Over time, human activity within the planning area has resulted in widespread and varied alterations to hydrologic systems. Stream system alterations include changes in flow regime, sediment transport, riparian vegetation, stream stability, floodplain function, and aquatic ecosystems. The majority of these changes are associated primarily with land management activities, including road construction, livestock grazing, vegetation management, recreation use, aquatic species management, water diversion/regulation, and mineral development.

<u>Roads</u>

The construction and maintenance of roads has long been recognized as a potential and major source of sediment in forested watersheds (Megahan and Kidd 1972; Reid and Dunne 1984). Roads can change natural runoff patterns by increasing the amount of impervious surface in a watershed, and/or by intercepting overland flow or shallow subsurface runoff. The network of road drainages

often routes this water, and the associated sediment, directly into streams (MacDonald and Stednick 2003). Sediment is the major pollutant associated with roads on public lands. Sedimentation in streams impacts water quality, which can, in turn, impact aquatic life. Sediment can also alter channel morphology, which can subsequently impact aquatic habitat.

Road construction and maintenance activities can result in physical changes to streams, including floodplain and riparian habitat modifications, channel degradation, and fish passage reduction. When roads and streams interact, there can also be economic impacts, including higher road maintenance and stabilization costs, and higher water treatment costs for public water supplies. It can also lead to rapid sedimentation, filling in water storage reservoirs and ponds. Ecological impacts commonly associated with stream/road interactions include aquatic, riparian, and wetland habitat degradation (USFS 2005).

There is an estimated 7,000 miles of road within the planning area. Most roads on the SJNF were initially built to facilitate timber harvesting. Some of these roads now serve multiple uses as part of the managed road system. Many roads persist on the landscape in an unmanaged state because they were never decommissioned after use. Most roads on BLM-administered lands were built primarily for minerals development and/or exploration or oil and gas development (and associated seismic exploration activities).

Many areas within the planning area exhibit road-related watershed impacts. In relation to roads, most of these watersheds were developed prior to current-day road construction standards and mitigation measures. The lack of funding for adequate road maintenance continues to be a serious problem on much of the 3,000 miles of authorized roads within the planning area. The thousands of miles of unauthorized or unmanaged roads are also problematic. Unauthorized roads have few plans in place or funds authorized to correct erosion/drainage/public use problems that are causing chronic impacts to some watersheds. Within the planning area, efforts at reducing road densities have resulted positive watershed results (e.g., Box Canyon Watershed). However, it is anticipated that degraded watershed conditions would persist until funds and/or priorities address road problems on a watershed-wide basis.

Road densities across the planning area vary from undeveloped wilderness to road densities of more than 6 miles per square mile. The average road density across the planning area is 0.8 mile per square mile (calculated in accordance with methods in the Route Density Guidelines found in Volume III, Appendix H). Watersheds with very high authorized and unauthorized road densities often show the greatest road-related impacts. Watersheds with the highest overall road densities within the planning area are summarized in Table 3.6.3; 21 of the top 25 watersheds (in terms of road density) have no USFS ownership (i.e., all public lands are under BLM management). Of these 25, nine are watersheds identified as having salinity issues in the 1974 Colorado River Basin Salinity Control Act (see Appendix I). In those watersheds where USFS ownership exceeds BLM ownership, the average road density is 0.6 mile/square mile. In watersheds where BLM ownership exceeds USFS ownership, average road density is 1.1 miles/square miles.

Table 3.6.3: Watersheds with the Highest Road Densities within the San Juan National Forest and Tres Rios Field Office

HUC 6	HUC 6 Watershed Name	Road Density (mile/square miles)	Agency
140300030410	Broad Canyon	6.4	BLM
140802020302	McElmo Creek-Trail and Goodman Canyon	5.9	BLM

140300021003	Bull Canyon	5.2	BLM
140300021101	East Paradox Creek	4.5	BLM
140300020706	Dolores Canyon-Nicholas Wash	3.7	BLM
140300030505	Lower Dry Creek	3.5	BLM
140300020513	Lower Disappointment Valley	3.4	BLM
140300030503	West Fork Dry Creek	3.3	BLM
140300020702	Summit Canyon	3.3	BLM
140300021001	Big Gypsum Creek	3.0	BLM
Note: Calculated in accordance with methods described in Road Density Guidelines (see Volume III, Appendix H), considering only watersheds with >1% USFS and/or BLM ownership.			

Livestock Grazing

Grazing practices that favor good range and riparian conditions typically have good water quality outcomes. Within the planning area, grazing has impacted riparian health, stream-channel conditions, upland infiltration and erosion, and water quality. The most common livestock-caused impacts include fecal/bacterial contamination, sedimentation, and increased temperatures. Livestock grazing activities with the highest potential for direct and indirect impacts to water resources include long-term concentrated grazing in riparian areas, and trampling/trailing near water sources. Direct bank damage may add large amounts of sediment directly into streams, especially in wet meadow streams or erosive topography that is prone to gully formation (USFS 2005). Unrestricted livestock use of water features (including streams, springs, seeps, and ponds) can also lead to water quality contamination (e.g., fecal and microbial).

Concentrated livestock grazing in riparian areas and wetland ecosystems may occur anywhere within the planning area; however, the lower-elevation drier rangelands tend to show more riparian grazing impacts when compared to higher-elevation forested watersheds. Long-term heavy grazing can shift native woody and herbaceous riparian vegetation into riparian areas dominated by non-native grasses and other vegetation, and result in a great reduction in native woody plants (USFS 2005). This, in turn, can lead to the destabilization of streams and to aquatic-habitat degradation.

Over time, there has been a shift from a predominance of sheep grazing on public lands to a current predominance of cattle grazing, with lower overall stocking rates. For example, in the 1930s, approximately 216,684 sheep and 41,968 cattle were permitted on the SJNF. In 2005, approximately 11,905 sheep and 22,382 cattle were permitted. Decreasing livestock numbers has, in turn, reduced watershed-wide impacts from overgrazing; however, localized problems still exist.

Livestock tend to follow predictable patterns of distribution on the landscape. In general, forested rangelands are not areas where widespread livestock impacts to water occur. Livestock use is often concentrated in high preference sites, including riparian areas and meadows. During the planning process, high-preference grazing areas were mapped for the planning area. Some watersheds have a high proportion of cattle preference areas located in valley floors where floodplains, streams, and riparian areas exist (see Table 3.6.4). These areas would most likely show more direct and indirect impacts to streams and riparian areas from historic and current livestock grazing (USFS 2005).

Table 3.6.4: Watershed Percent of Valley Floor in High Cattle Preference Grazing Areas

HUC 6	HUC 6 Watershed Name	Percentage of Valley Floor in High Cattle Preference Areas	Agency
140300020402	Beaver Creek - Trail Canyon	68.1%	USFS
140300020601	Dolores River - Salter Canyon	60.1%	USFS

140300020406	McPhee Reservoir - Beaver Creek Inlet	56.0%	USFS
140300020602	Narraguinnep Canyon Natural Area	55.8%	BLM/USFS
140300030307	House Creek	55.2%	USFS
140801040701	Florida River Headwaters	52.3%	USFS
140300020304	Middle Lost Canyon	49.3%	USFS
140300020509	Pine Arroyo	48.7%	BLM/USFS
140300020507	Dawson Draw	48.1%	BLM/USFS
140801020103	Williams Creek	46.5%	USFS
140801010304	Middle Rio Blanco	46.1%	USFS

Within the planning area, vegetation management is expected to comply with the most current policies and management techniques. Range condition should continue on the same trend as the last decade; however, the protection and improvement of riparian areas and wetland ecosystems would likely need additional emphasis.

Vegetation Management

Hydrology, water quality, riparian areas and wetland ecosystems health and function, as well as channel and biotic conditions, may all be adversely impacted by large-scale vegetation management (Chamberlin et al.1991). The primary vegetation management tools used within the planning area include timber harvesting, timber stand improvements (TSIs), range management treatments, and fuels reduction. Table 3.6.5 shows the approximate total acreage within the planning area that had different types of vegetation management treatments over the past 30 years.

Range treatments on NFS and BLM-administered lands include seeding, planting, and piling slash. Timber activities occur almost exclusively on the NFS lands within the planning area and include activities such as site preparation (burning and mechanical), harvesting (regeneration cuts, intermediate cuts, and salvage), and slash treatment.

Table 3.6.5: Vegetation Treatments

Treatment Type	Acres Since 1976	Agency	Land Base on the SJNF and TRFO
Range improvement	40	USFS	0.01%
Timber activities	227,300	USFS	12%
Range and other vegetation treatments	49,600	BLM	7%

Timber harvesting on NFS lands has been concentrated in some watersheds, while no harvesting has occurred in other watersheds. Watersheds that have the highest level of harvest, in relation to the clear-cutting method, are summarized in Table 3.6.6.

Table 3.6.6: Greatest Clearcut Harvest Areas

HUC 6	HUC 6 Watershed Name	Percentage Watershed Harvested by Clear-cutting	Percentage River Valley Floor Harvested by Clearcutting
140300020205	Roaring Forks Creek	11.26%	0.62%
140300020303	Upper Lost Canyon	10.61%	2.36%
140801011301	Upper Beaver Creek	10.52%	1.40%

HUC 6	HUC 6 Watershed Name	Percentage Watershed Harvested by Clear-cutting	Percentage River Valley Floor Harvested by Clearcutting
140801040402	Hermosa Creek Headwaters	7.76%	0.40%

Some watersheds have been impacted by large areas of clear-cut harvesting; however, only a small amount of activity has occurred within river valley floors. When all harvesting methods over the past 40 years are considered, approximately 204,700 acres have been harvested in uplands, and approximately 44,700 acres have been harvested within river valley floors.

Harvesting large areas of timber, especially stand conversion timber harvesting, can result in changes in soil water content and water yield, and may create localized site-stability issues. The watersheds identified in Table 3.6.6 may be the most at-risk watersheds for these types of impacts. However, the cumulative impacts of physically harvesting, skidding, building roads, transporting logs, disposing of slash, and preparing sites have a much greater impact on watersheds, when compared to the changes made to vegetation alone. Some watersheds are highly sensitive to disturbances, including timber harvesting activities (see Appendix I).

Water Uses

Development of water for human use has long been a common occurrence in southwest Colorado. Limited irrigation occurred as far back as the Pueblo III period (between A.D. 1150 and 1300). Around Dolores, Mancos, Dove Creek, and Cortez, springs and seeps were developed in order to irrigate small terraces of usually less than 5 acres (Arrington 2006). Along with the earliest European settlements, diversion of water was a common occurrence and included irrigation and mining activities.

Today, there are approximately 1,900 water rights that divert water from streams and springs located within the planning area. A majority of these water rights are owned by non-federal entities. The size of private water developments, as well as the related amount of water diverted, varies greatly. Small developments for individual families often use less than 15 gallons/minute, while larger irrigation or hydroelectric diversions can be 50 cubic feet per second (cfs) or more. McPhee Reservoir, the largest on-channel reservoir within the planning area, has a total storage capacity of approximately 381,195 acre-feet (Bureau of Reclamation 2006).

There are also hundreds of water impoundments located throughout the planning area. Water impoundments and water diversion projects have resulted in numerous direct and cumulative impacts to stream channels, floodplains, aquatic ecosystems, and riparian area and wetlands ecosystems. Ditch failures and maintenance activities often introduce large quantities of sediment into waterways. Diverting water from streams into ditches can result in major alterations to stream-transport processes. This practice can also reduce or eliminate flow, which, in turn, can affect aquatic ecosystems and habitat. Dam regulation can change stream flow timing and quantity, and disrupt sediment routing, which, in turn, can affect ecosystems and physical stream characteristics.

There are many examples of developments for water storage and diversion affecting water-dependent resources within the planning area. One example is the McPhee Reservoir. This project affects almost 100 miles of the Dolores River within the planning area. Since the construction of the reservoir, native and desired non-native fisheries have declined, and recreational boating has been curtailed. Riparian areas and wetland ecosystems, river channels, and floodplains have also been

greatly modified. Several grassroots efforts have focused on possible solutions designed to improve conditions on the lower Dolores River.

The Blanco Tunnel diverts water from the Blanco River into an underground tunnel for delivery to New Mexico reservoirs. Approximately 8 miles of the Blanco River within the planning area below the Blanco Tunnel are impacted by the greatly reduced flows. Sedimentation problems exist, in part, due to these reduced-flow and diversion operations.

Although one large diversion or impoundment may result in large aquatic resource impacts, many small diversions may also cumulatively impact streams. Watersheds identified in Table 3.6.7 have the greatest number of diversions found within the planning area, and are, as a result, most likely to exhibit cumulative impacts from water development activities.

Table 3.6.7: Watersheds with the Most Water Diversions

HUC 6	HUC 6 Watershed Name	Diversions	Agency
140801011403	Los Pinos River-Bayfield	49	BLM/USFS
140801010404	Upper Pagosa Springs	39	BLM/USFS
140801040503	Upper Animas Valley-Stevens Creek	36	USFS
140802020101	Simon Draw	36	BLM
140801010606	Navajo River-Weisel Flat	31	BLM/USFS
140801010303	Rio Blanco River-Blanco Basin	29	USFS
140801040504	Upper Animas Valley-Trimble	26	BLM/USFS
140801050102	Hay Gulch	26	USFS
140801040502	Elbert Creek	25	USFS
140801011501	Dry Creek	24	BLM
140801070104	East Mancos River-Middle Mancos River	23	BLM/USFS
140801010204	Lower West Fork San Juan River	22	USFS
140801020501	Yellowjacket Creek	21	USFS
140801070103	Chicken Creek	21	BLM/USFS
140801040901	Middle Animas Valley-Smelter Mountain	20	BLM
140801010402	Laughlin Park	19	USFS
140801050106	Upper Cherry Creek	19	BLM/USFS
140801040604	Animas River-Spring Creek	18	BLM/USFS
140801010305	Rito Blanco	17	USFS
140801010403	Fourmile Creek	17	USFS

The data shown above reflects ditches and pipelines with water rights diverted from streams, in watersheds having 5% or more USFS or BLM ownership. The demand for water development from public lands would continue to increase over time. Projections show that populations could increase by approximately 89% throughout the Dolores, San Juan, and San Miguel basins over the next 30 years (CWCB 2004). The current drought cycles being experienced throughout the Southwest would add to water development pressure. New water storage projects are continually proposed on public lands. After the 2002 drought, the number of water rights filings within the planning area greatly increased. The drought also caused the State of Colorado to study water shortage issues comprehensively up to the year 2030 and create a process to help solve predicted shortages. It is expected that some local solutions from the Statewide Basin Roundtable process would include new water development within the planning area.

During the creation of this LRMP/FEIS, desired future conditions for water-dependent resources were developed. The emphasis would be placed on protecting aquatic ecosystems and maintaining streams, floodplains, and watersheds that function well. Maintaining or restoring functioning

watersheds and stream systems would ensure that water quality and habitat are protected, as required by federal and state laws, regulations, and policies. However, demand for new water projects, as well as for proposals to change existing water facilities, may occur. See Table 3.6.8 for a list of the largest reservoirs in the planning area.

Table 3.6.8: Largest Reservoirs on the San Juan National Forest and Tres Rios Field Office

Reservoir	Water Source	Use	Agency
Electra Lake	Cascade Elbert Creeks	Hydroelectric power generation	USFS
Jackson Gulch	Mancos River System	Irrigation and domestic use in Mancos Valley; hydroelectric	BLM
Lemon Reservoir	Florida River	Irrigation for Florida Mesa, La Plata County; hydroelectric	USFS
McPhee Reservoir	Dolores River	Irrigation and domestic in Cortez, Dove Creek, Ute Mountain Ute Tribe, and other irrigated lands; hydroelectric	USFS/BLM
Summit Lake	Lost Canyon	Irrigation for lands in Montezuma County	BLM
Vallecito Reservoir	Los Pinos River	Irrigation for the Southern Ute Indian Tribe and other irrigated lands; hydroelectric	USFS
Williams Creek Reservoir	Piedra River System	Wildlife, CPW	USFS

Wells and Other Groundwater Developments

Previous RMPs related to the planning area did not, for the most part, address groundwater resources. Over the last 10 years, proposals to develop large quantities of groundwater for consumptive use have been steadily increasing. It was recently recognized that the large volumes of groundwater produced during fluid minerals extraction could impact aquifers and the connected surface water features.

There are approximately 634 water wells located on NFS and BLM lands within the planning area. Table 3.6.9 summarizes basic information about existing wells. Over the past 30 years, 23,000 oil and gas production wells have been drilled in the San Juan Basin. In order to recover methane (CH_4) gas, many of these wells require pumping of groundwater from the Fruitland and Pictured Cliffs formations. An estimated 25,000 barrels of water per day is produced from the San Juan Basin as a result of CBM development. To date, a typical CBM well in this basin has produced 250,000 barrels of water. Almost all of this water is disposed of through reinjection into deep aquifers of poor water quality (BLM and USFS 2006a).

Table 3.6.9: Wells on the San Juan National Forest and Tres Rios Field Office

Primary Use	USFS	BLM
Irrigation	2	3
Municipal	16	5
Commercial	35	7
Industrial	2	16
Recreation	2	0
Domestic	265	82

Primary Use	USFS	BLM
Livestock	4	16
Geothermal	5	0
Other	78	96
Total	**409**	**225**

According to a body of evidence drawn by researchers studying the issue of groundwater surface water interaction in the San Juan Basin, groundwater pumping from the Fruitland Formation has the potential to impact surface water quantity. As the dewatering of the Fruitland Formation continues, there is the potential for reductions in water quantity to streams, springs, seeps, and riparian areas and wetland ecosystem.

Groundwater pumping also occurs in conjunction with CO_2 development in the Leadville Limestone on BLM-administered lands in the western portions of the planning area. Quantities of water vary from 1,000 to 2,166 barrels per day, and the water is of poor quality with high total dissolved solids and salt (Kinder Morgan 2005).

Within the planning area, large-scale energy development would continue to result in changes within the Fruitland Formation aquifer. Pumping produced water would continue as existing wells, and a projected 11,000 new wells, are drilled within the San Juan Basin (including in New Mexico) over the next 10 years. At some point, localized portions of the Fruitland Formation aquifer could be effectively dewatered. Some projections show that it would take several centuries to recharge this aquifer (Cox et al. 2001). Dewatering of this aquifer has the potential to cause some springs, seeps, streams, and wetlands located on the Fruitland Formation outcrop to run dry (BLM and USFS 2006a).

<u>Mining and Mineral Development</u>

The mountains surrounding Silverton, Rico, Mancos, and La Plata City have historically been areas of intensive mining. Early placer and hydraulic mining resulted in impacts to floodplains and water quality in the La Plata, Dolores, and Mancos Rivers. Hard-rock mine drainage and tailings have increased the natural geologic background of metals and acidity, and have further impacted the water quality of several rivers and aquifers in the Animas River (near Silverton), the La Plata River, the East Fork Mancos River, the Dolores River (near Rico), and the West Fork Dolores River (near Dunton).

Water quality trends vary across the planning area. Some streams and rivers within the upper Animas River watershed were determined to be impaired by the State of Colorado due to heavy metals pollution. The SJNF and TRFO have an active abandoned mine and lands clean-up program. Current clean-up efforts have focused primarily on the upper Animas River watershed. Clean-up work in the upper Animas River, and other polluted watersheds, is anticipated to continue over the next 15 years.

CBM and CO_2 extraction processes may impact groundwater resources, while the infrastructure necessary for fluid minerals development and transport (e.g., roads, well pads, pipelines, and compressor stations) may result in large impacts to watersheds managed by the SJNF and TRFO. Where well densities are high, the impacts of infrastructure may be more pronounced. Sedimentation and altered runoff patterns are perhaps the largest contributing factors to surface watershed degradation associated with this type of energy development (BLM and USFS 2006a). Even with widespread mitigation, the cumulative impacts associated with building roads, pipelines, well pads, and other infrastructure have been large in some areas. For example, mitigation measures would be implemented in order to reduce sediment delivery to surface water sources; however, high road, pipeline, and well pad densities may continue to cumulatively impact water resources.

3.6.3 Environmental Consequences

Direct and Indirect Impacts

The types of activities discussed in the following sections have all previously occurred on lands covered by this LRMP/FEIS. Based on observations from previous projects, oil and gas development has the ability to produce greater direct and indirect impacts than most of the other analyzed activities. As a consequence, discussion of the impacts from oil and gas development is separate and more detailed than the discussion of other planning area activities.

Impacts Related to Watershed, Riparian, and Aquatic Habitat Improvement Projects

As a result of the cumulative impacts of previous management activities, some watersheds located within the planning area exhibit poor conditions. During the Watershed Condition Framework (a recent assessment of 6th-level watersheds on NFS lands), three of 139 watersheds were found to be impaired, and 63 of 139 were found to be functioning, but at risk. A similar assessment has not been completed for watersheds on BLM lands. Maintaining healthy stream-channel function would be a central focus under all of the alternatives, with the goal being that streams effectively transport discharge, sediment, and periodic flooding, and provide aquatic and riparian habitat, as well as a broad spectrum of recreational opportunities. Under all of the alternatives, priorities for SJNF and TRFO watershed restoration programs would focus on pollutant reduction on State of Colorado 303(d) listed streams, saline soil watersheds, or watersheds identified as having the highest level of cumulative impacts or high sensitivity to management activities.

Each of the FEIS alternatives would propose annual watershed restoration projects (including erosion control, stream restoration, riparian/lake/fen treatments, road decommissioning, and/or fish habitat improvement). Alternatives B and C would propose similar goals, with Alternative C treating more acres and stream miles than all other alternatives. Alternatives A and D would treat substantially fewer acres and stream miles than Alternatives B and C, meaning that Alternatives B and C would produce the highest levels of positive watersheds impacts.

Impacts Related to Road Densities

Using current direction or guidance for the management of roads may greatly reduce impacts to water-dependent resources. Direction can be found in the Water Conservation Practices Handbook (USFS 2006a) and the Surface Operating Standards for Oil and Gas Development (BLM 2006a). Effective measures would include locating roads away from streams, riparian areas, steep slopes, landslide-hazard areas, and high erosion areas. Providing adequate drainage, enforcing seasonal road closures, preserving sediment-filtration buffers, and constructing perpendicular road crossings may also serve as effective mitigation measures.

On NFS lands the current LRMP addresses limiting road densities in specific areas, while no guidance exists for lands under BLM ownership. New guidelines applicable to NFS and BLM lands focus on decommissioning temporary and/or unauthorized roads, and would direct focus to watersheds sensitive to disturbance and watersheds with salinity concerns. New guidelines applicable to all NFS lands focus on limiting route densities by 6th-level HUC, while guidelines pertaining to BLM lands provide no specific direction relative to desired road densities. For this reason, the risk is high that impacts would occur on BLM lands from proposed road construction in watersheds with high existing road densities. The guidelines on NFS lands may result in positive trends in some areas; however, progress is expected to be slow due to limited resources, the large

numbers of current unauthorized roads, and the fact that the large majority of watersheds on the SJNF are currently below the suggested route density guidelines.

All of the alternatives would be subjected to the same access and travel management and water guidelines. Consequently, the differences in watershed impacts would be primarily related to the variations between the alternatives in OHV area designations and motorized suitability determinations, and the number of road miles planned for decommissioning. It would be expected that Alternative C would have the fewest detrimental watershed impacts, followed by Alternative B, then Alternatives A and D. These differences are driven by the larger number of acres classified as suitable or suitable opportunity areas for motorized travel under Alternatives B and C.

Impacts Related to New Road Construction and Reconstruction

The majority of the road-related potential impacts to watersheds would be associated with new oil and gas activities, which are discussed below. New road construction and reconstruction occurring within the planning area would also be associated with timber harvest. Even with the implementation of guidelines and mitigation measures designed to reduce sediment, the construction of new roads may result in watershed impacts. Mitigation measures would reduce, but would not eliminate, sediment delivery. Roads interrupt and concentrate overland flow, contribute to erosion, and, in some areas, add to existing high road densities, which may add cumulative watershed impacts. Increased delivery of salt and sediment to the upper Colorado River and increased impacts to streams and aquatic habitat may occur under all of the alternatives.

Plans for future timber harvesting may require new road construction and reconstruction. At this time, the size, timing, and/or location of future timber harvesting is not known; therefore, road impacts can only be discussed in a general sense. Suitable timber production acreage is very similar under all alternatives, showing less than 5% variation. As a result, all alternatives have a similar potential for watershed impacts associated with road construction stemming from timber harvesting.

Smaller amounts of new road construction may also be associated with recreation development, minerals development, Special Use Permits, and other activities. Although the amount of road construction necessary for these activities is unknown until projects are proposed, the impacts of these activities are not expected to vary by alternative.

Impacts Related to Livestock Grazing

Excessive or unrestricted grazing by permitted livestock and big game may result in widespread impacts on watershed health and water resources. On drier BLM-administered lands it is common for livestock to concentrate within valley/canyon floors and in riparian areas. This results in water quality (including in riparian areas and wetland ecosystems) and rangeland degradation. Cattle favor the easy access to water and the better forage found in lower-elevation riparian areas. For the majority of USFS watersheds within the planning area, grazing over the last decade has had moderate to low direct and indirect impacts on watershed or stream health (USFS 2005). Long-term chronic grazing problems that impact water resources occur in localized areas across the planning area. Areas commonly impacted by livestock grazing include mountain grasslands, riparian areas and wetland ecosystems, alpine vegetation, semi-desert grasslands, and places where livestock concentrate directly on or near water sources.

The impacts related to livestock grazing on water resources in the planning area may include increased grazing pressure on areas that are sensitive to impacts (such as riparian areas and wetlands ecosystems, and wet meadows). Increased grazing pressure in these sensitive areas may

degrade aquatic and riparian conditions through the direct, physical removal of vegetation and trampling or through the indirect changes to vegetation species composition, decreased shading/increased water temperatures, and changes in water chemistry (USFS 2005). The protection and improvement of riparian areas and wetland ecosystems would receive emphasis under all of the alternatives; however, the degree of success would depend largely on individual grazing permittees. Should grazing be determined to be the cause of impacts to water resources through monitoring, grazing practices would be adjusted to mitigate identified impacts.

For permitted livestock grazing, as well as the acres of land suitable for livestock grazing, Alternative D may result in the highest potential impacts to watersheds and water resources because, out of all of the alternatives, it would propose the largest amount of suitable acreage for both sheep and cattle grazing, as well as the largest amount of projected AUMs for both sheep and cattle. Alternative C would have the fewest acres of land suitable for cattle and sheep grazing and the lowest potential AUMs; therefore, it would have the lowest potential watershed impacts. Alternatives A and B would propose a very similar number of suitable livestock grazing acres and AUMs; therefore, the potential impacts to watershed resources would be similar in magnitude. The direct, indirect, and cumulative impacts of domestic livestock grazing may increase, relative to current conditions, under Alternative D.

Impacts Related to Timber Harvesting and Fuels Treatment

Water Yield Impacts - Timber harvesting and fuels treatments are vegetation management activities that have the potential to impact watersheds and stream health. Major reductions in forest canopy can increase water yield in high-elevation forested watersheds such as spruce-fir forests or cool-moist mixed conifer forests. These increases can be large in some regions. However, in the hydroclimatic regime of the analysis area, annual climate variations are much more important than alterations from timber harvest. Flow increases occur mostly during spring runoff and during the summer; they are not significant until about 25% of the basal area of a forested watershed is cut (USFS 1980). Large openings can suffer snow scour that can reduce site moisture and water yield (USFS 2006a).

Timber harvesting acres would be spread throughout many forested watersheds within the planning area; however, their exact amount and location would not be known until specific projects are proposed. It is not expected that watersheds would receive timber harvesting treatments that would exceed 25% basal area removal over the life of the final approved LRMP; therefore, detectable changes in water yield would, generally, not be a concern. On a site-specific basis, certain sensitive watersheds can have water yield concerns. Some watersheds are prone to mass failure and may be especially sensitive to small changes in water yield. Other watersheds have experienced large amounts of disturbance (including as a result of past management activities, severe climatic events, and/or large wildfires) and may have water yield issues. Those watersheds would be analyzed on a project-by-project basis in order to evaluate if water yield concerns exist. Then the appropriate standards and guidelines would be applied to such projects, as needed, in order to reduce water yield concerns. The volume of timber harvesting is anticipated to be lower than predicted in the current LRMP and would be largely limited to existing roaded areas. The large-scale road construction that occurred over the past decades is not anticipated to occur during the next planning period, because most of the infrastructure is already in place within the planning area.

In terms of timber harvesting, the volume of timber harvesting is similar under all alternatives, lower than predicted in the current LRMP, and largely limited to existing roaded areas. Large-scale road construction is not anticipated to occur during the next planning period, because most of the

infrastructure is already in place within the planning area. In terms of fuels treatments, there is no meaningful variation between the alternatives; therefore, the potential impacts to watersheds may be identical under all of the alternatives. In general, fuels treatments would not be expected to result in measurable impacts to water yield because such treatments (including mechanical treatments and prescribed burns) primarily target the understory and small-diameter trees; therefore, they may not measurably alter basal area (except in dry, pinyon-juniper vegetation types). Wildland fire use, on the other hand, may have the potential to result in large changes in basal area and, consequently, may increase water yield, depending on the individual fire. The potential for increased water yield is greatest if wildland fire use occurs in spruce-fir and cool-moist mixed conifer stands that exist in the wettest areas within the planning area.

Water Quality Impacts - Sediment is the primary pollutant associated with timber harvesting. With regard to all timber harvesting activities, implementation of water conservation practices, BMPs, guidelines, and relevant standards and guidelines are typically effective in preventing or reducing sediment delivery to water bodies. Road construction associated with timber harvesting has a higher potential to impact water quality. New road construction has the greatest potential for direct or indirect watershed impacts associated with timber harvesting (Megahan and Kidd 1972; Reid and Dunne 1984). Reconstruction on stabilized roads that are covered with vegetation can generate increased sediment (Swift 1984), just as new road construction is a large source of sediment to forested watershed streams.

Vegetation management activities within the planning area are expected to comply with the most current policies and management techniques. The reduction of wildfire risk through fuels treatment would continue to be emphasized on public lands. In the long term, reducing the risk of uncharacteristic wildfires may be a benefit to watersheds and may support the desired conditions for overall water quality (including stream channels, floodplains, groundwater, and watersheds).

The volume of timber harvesting is expected to be similar under all proposed alternatives. Consequently, impacts to water quality from timber harvest are expected to be similar in both type and magnitude under all alternatives.

Impacts Related to Water Development Projects

Depending on the size and type of project, the development of water for uses within the planning area (as well for adjacent private properties) may result in a range of potential impacts to stream channels, aquatic habitat, and riparian vegetation. However, the direct, indirect, and cumulative impacts of water development are speculative at this point because the number of proponent-driven projects projected within the timeframe of this LRMP/FEIS is unknown.

Most water uses within the planning area are primarily for livestock and wildlife watering, recreation (campgrounds), and administrative sites. There are also a small number of irrigation and fish pond (piscatorial) water uses. With the exception of irrigation and piscatorial uses, the amount of water for planning area uses tends to be small (usually less than 5 gallons per minute, or 0.01 cfs for a source of water). Each year, for the next 10 years, it is expected that there could be an average of two new livestock developments within the planning area. The total quantity of water used by livestock and wildlife would not change much over the next planning period. Most livestock and wildlife developments would be built in order to move the use from the actual source of water to a site that protects an area from trampling and contamination or to facilitate better grazing distribution (which may benefit water quality and riparian habitat). Development of water may also occur if new campgrounds are built or if/when existing campground water use shifts from surface sources to wells

to protect public health. The number of new water developments for uses within the planning area is not expected to vary by alternative.

Diversions reduce or eliminate downstream flows, which may, in turn, affect channel size and limit habitat for aquatic and riparian species. Dams alter flow regimes by storing water during runoff (for later release). Dams and diversions can impose substantial barriers to migration of aquatic species and can dewater streams during certain time periods, which can, in turn, fragment aquatic ecosystems (USFS 2005). In some cases, altered flow regimes prolong periods of runoff and can enhance riparian vegetation communities. Water wells can reduce the amount of water in connected streams, springs, and seeps, which, in turn, can have similar impacts to structural water diversions.

Dams impact stream channels in different ways, depending on their operation. Reservoirs store sediment and release sediment-free water below the dam. Water storage reduces peak flows, which, in turn, can reduce the frequency and magnitude of flushing flows. The result can be the reduction of channel capacity, alteration of aquatic habitat, and changes in temperature and other factors that can affect spawning and reproductive success of aquatic species.

It is estimated that new water development projects would continue to be proposed for the planning area in order to meet private water supply needs. Alterations in the availability and timing or runoff under projected climate change scenarios, as well as population growth, may also be factors that lead to increased water development applications for the planning area. The SJNF and TRFO have the responsibility to ensure that permits are consistent with the revised LRMP, as well as with all other applicable laws and regulations. As permits are amended, renewed, or issued, the water projects would be analyzed for environmental impacts, as well as to determine what terms and conditions are necessary.

Some projects may result in major impacts to water resources; however, these impacts are not expected to vary between the alternatives. This is because demand for water use authorizations is driven by proponents, rather than by SJNF and TRFO programs or budgets.

Impacts Related to Solid Minerals Mining and Mining Reclamation

Mining activities conducted within the planning area may include gravel operations, landscape rock, hard-rock mining, and uranium mining. New mining operations for locatable minerals are expected to be small and limited in quantity. Increases in mining activity are not anticipated; however, to a certain extent, this cannot be predicted. Federal authority over mining activities allows for the setting of terms and conditions in operating plans in order to minimize impacts to public lands. Mining activities may impact water quality and quantity.

The abandoned mines reclamation occurring within the planning area is an intensive program. This is due to the high number of abandoned historic mines in the San Juan Mountains. As work is completed, the number of sites reclaimed is expected to remain steady or to slowly decrease over the next decade. Mine reclamation work is not expected to vary by alternative. The primary objectives of this program include improving water quality and watershed condition. This work is expected to have a net positive impact on water resources under all of the alternatives.

The acres projected for solid minerals development show very little variation between the alternatives; consequently, watershed impacts are expected to be similar for all alternatives.

Impacts Related to Fluid Minerals Development

Groundwater Resources

Impacts to groundwater from projected oil and gas development within the PLAA may occur, assuming that the high potential unleased lands are leased and developed. Primary groundwater concerns for gas development in the PLAA area encompass two broad categories. The first concern is reduced groundwater quantity due to consumptive use during well drilling, well completion, and well operation. The second concern is the potential for reduced water quality due to hydraulic fracturing, subsurface reinjection, and surface spills of produced water or flow back fluids.

Under Alternatives A through D, roughly 8,900 acre-feet of freshwater would be consumed for the drilling and completion of approximately 1,200 wells (Table 3.6.10). Purchase of this water would be required from private sources off federal lands; consequently, the direct and indirect effects on groundwater resources on NFS and BLM lands are unknown due to the lack of specific project proposals at this time.

Table 3.6.10: Acre-feet of Water for the Drilling and Completion of Wells on Currently Leased and Unleased Federal Lands in the Paradox Leasing Analysis Area, All Wells Conventional and Shale Gas

Alternative		Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
USFS	Leased	827	827	827	827	827
	Unleased	4,453	4,184	3,703	4,437	0
BLM	Leased	2,470	2,470	2,470	2,470	2,470
	Unleased	1,780	1,226	1,092	1,617	0
Total		**9,530**	**8,707**	**8,092**	**9,351**	**3,297**

During the production of gas, water is typically removed from producing intervals. This water is referred to as “produced” water. Based on the low water yield of many of the formations in the PLAA, as well as the large vertical separation and confining layers between groundwater wells and the target formations of the PLAA (>4,000 feet), the extraction of produced water should not directly or indirectly impact the quantity of groundwater available for domestic and municipal uses.

Hydraulic fracturing would be used to increase gas production from gas-bearing formations. While the exact composition of hydraulic fracturing fluids is proprietary, the majority is fresh water. Minor constituents (<5%) typically include biocide, acid, potassium chloride, gelling and breaker agents, scale and corrosion inhibitors, pH chemicals, friction reducers, and surfactants. While these constituents compose a minor fraction of the fracturing fluids, some additives are known to have adverse human health effects, even in small concentrations (Colburn et al. 2011). During well completion, a portion of the injected hydraulic fracturing fluids is returned to the surface as flow back fluids. Flow back fluids contain fracking materials mentioned above, as well as constituents derived from the target formation, such as hydrocarbons, salts, and minerals.

Due to the large vertical separation between groundwater supply wells and the target formations of the PLAA (>4,000 feet), as well as the presence of confining layers, it is unlikely that hydraulic fracturing would result in the contamination of useable groundwater resources by means of contaminant movement through the intervening formations. For the same reason, it is also unlikely that hydraulic fracturing would result in vertical migration of saline groundwater from the lower Paleozoic carbonate aquifer systems upwards into the upper Mesozoic sandstone aquifer systems.

The most likely means by which hydraulic fracturing fluids or saline water could migrate into the upper Mesozoic sandstone aquifers would be through vertical migration along damaged or poorly constructed well bore holes, or if fracturing extends into zones of geologic weakness, such as fractures and faults that are conduits to other zones (USGS 1996; P. Leschak, personal communication, September 10, 2010). The potential for short-term impacts, related to the vertical migration of hydraulic fracturing fluids and groundwater from the lower Paleozoic aquifer, would be mitigated through the implementation of the standards, guides, and leasing stipulations contained in the FEIS. Additionally, BLM oil and gas regulations require operators to isolate freshwater-bearing and other usable water containing 5,000 parts per million (ppm) or less of dissolved solids and other mineral-bearing formation and protect them from contamination (43 CFR 3162.5-2(d)). Implementation of these regulations, BMPs and the plan standards and guidelines are effective in preventing vertical migration of saline water and hydraulic fracturing fluids (P. Leschak, personal communication, September 10, 2010).

Options for the disposal of produced water and flow back fluids typically consist of temporary pit or tank storage and subsequent transport to an off-site treatment facility or injection into deep permeable subsurface target formations of poor water quality. With on-site tank or pit storage, there would be some risk of contaminating shallow groundwater resources by leakage or spills. This risk is effectively mitigated with standard 2.6.31 from the LRMP, Volume II requiring closed loop drilling systems and guideline (2.6.35 requiring non-toxic drilling fluids. Other requirements include lining storage pits with plastic and berming to provide several feet of freeboard. BMPs 15.1 and 15.2 of FSH 2500.25 would be applied to ensure new sources of chemical pollutants do not reach groundwater (USFS 2006a). Other requirements include locating vehicle and service areas, chemical storage and use, and dump areas on gentle upland sites, citing facilities away from springs, seeps, and streams, and preventing entrainment into water sources. Chemicals and containers would be disposed of in state-certified disposal areas. Berms and trenches would be installed around the storage pits, well pads, and around chemical storage and use areas. Any waste material or disturbed areas would be revegetated, and equipment would be inspected daily for leaking chemicals. These measures would be effective in preventing the contamination of groundwater resources.

Another concern with exploration and development in shale gas plays (such as the GSGP) is the contamination of drill cuttings, produced water, and flow back fluids with naturally occurring radioactive materials. Subsequent handling of these products can concentrate the solids and elevate the level of radioactivity, resulting in technologically enhanced naturally occurring radioactive materials. The level of radioactivity in shale gas plays within the planning area is relatively poorly understood. This LRMP contains a lease notice (see Appendix H) that would require data collection and reporting on naturally occurring radioactive materials. The disposition of naturally occurring radioactive materials and technologically enhanced naturally occurring radioactive materials is regulated by the CDPHE.

Reinjection of produced water and flow back fluids into target formations is the typical method of disposing of waste fluids. This practice results in gradually increasing pressures within a specified radius from the injection well. Pressure increases are a function injection rate and the thickness and permeability of the target formation. EPA and Colorado regulations require injection wells be operated in a manner that injection pressures do not induce fracturing in the target formation, thereby confining injected water in the target zone. The underground injection control program, which regulates water injection, delegated from the EPA to the State of Colorado, requires that injections not “manifest themselves in shallow aquifers or useable groundwater supplies.” Groundwater supply wells have a large vertical separation (thousands of feet) from potentially targeted formations; consequently,

mixing between injected and native water would not affect exploitable or useable groundwater resources.

Each of the alternatives represents a major increase in projected development relative to the No Leasing Alternative; however, the differences in the number of wells between Alternatives A through D are relatively minor, with about 17% difference between Alternatives A and C (relative to the Preferred Alternative). Consequently, the primary differences between the alternatives come in the form of variations in leasing stipulations. The No Leasing Alternative would have no new direct or indirect impacts from gas development, as it would not make any additional lands available for lease.

In addition to proposing fewer wells, Alternatives B and C offer additional guidance on the protection of groundwater resources in the form of CSU special lease stipulations. These stipulations are targeted to prevent contamination of potentially useable groundwater resources (both shallow and deep) and provide significant protections above those of the standard lease terms. Consequently, Alternatives B and C would have fewer environmental impacts to groundwater resources than Alternatives A and D. Between Alternatives B and C, Alternative C would have fewer groundwater resource impacts due to the lower number of wells. The difference between Alternatives B and C is expected to be small, when compared to the potential impacts from either Alternative A or D.

Surface Water Resources

If not mitigated, gas development in the PLAA could potentially result in a broad range of watershed effects. The principal effects include increased erosion and sedimentation due to ground disturbance from the construction of new roads, well pads, pipelines, compressor stations, and other ancillary facilities. Many of these facilities are considered to be long-term sources of ground disturbance, each of which would have the potential to increase erosion and sediment transport to surface waters. Additional potential impacts include the contamination of surface water resources via spillage of fluids associated with oil and gas exploration and production.

Among the facilities constructed, roads are considered to have the highest potential for being major long-term sources of sediment (Megahan and Kidd 1972; Reid and Dunne 1984). With their construction and operation unmitigated, roads can alter stream hydrology in numerous ways. Increased stream discharge, alteration of peak flow timing, and modification of a stream's normal sediment loads can all occur where roads are associated with stream drainages. The increase in flow quantity and sediment loads could modify stream channel morphology and degrade water quality. As a result, non-compliance with water quality criteria and standards could occur, as well as degradation and impacts to related aquatic resources. Additional road-related effects can also include modification of floodplain function and modification to riparian habitat, as well as altering or preventing fish passage.

As the result of oil and gas development within the PLAA, the total miles of roads on NFS lands would be expected to increase by roughly 255 miles, while BLM lands would see an increase of approximately 226 miles. This increase in mileage would be distributed over roughly 947 USFS and 679 BLM square miles, resulting in an increase in road density of 0.26 mile/square mile on NFS lands and 0.33 mile/square mile on BLM lands (averaged across the landscape of the PLAA). Localized increases in road densities would be much higher in some areas, due to the complex interplay of ownership, leasing stipulations, and spatially heterogeneous shale gas resources. It would be expected that both NFS and BLM lands would realize the impacts discussed in the preceding paragraphs, namely increased erosion and sedimentation.

The difference in road density changes between NFS and BLM lands would be further influenced by several factors. BLM lands typically have a disproportionate amount of marine-derived shale soils, and BLM lands are not subject to the same route density guidelines as NFS lands. On NFS lands road density guidelines could effectively create reductions in road density in some watersheds or at a minimum place emphasis on maintaining lower road densities in particularly sensitive watersheds (see Appendix I). The PLAA contains all or portions of thirty 6th-level HUC watersheds that were identified in the Colorado River Basin Salinity Control Act of 1974 as having potential salinity issues. BLM ownership exceeds USFS ownership in 24 of the 30 watersheds; however, road density guidelines on BLM lands would likely mitigate salinity contributions from development in these watersheds.

Special lease stipulations that address surface water resource protection include CSU, NSO, and standard lease terms (see Appendix H for a complete set of stipulations), employment of these stipulations varies substantially by alternative. These stipulations are designed to avoid development on slopes greater than 40%, protect perennial water impoundments and streams, and protect riparian areas and wetlands by moving oil and gas exploration and development beyond the riparian vegetation zone. Additional protections are also provided municipal supply watersheds, and the NSO stipulation would also be used to avoid wetlands, floodplains, water influence zones, and fens, all of which are easily disturbed and susceptible to adverse changes in hydrologic function.

Watershed impacts would also be mitigated through the application of BMPs. BMPs are a proven effective set of practices for preventing or minimizing impacts to hydrologic resources (Schuler and Briggs 2000; Seyedbagheri 1996; USFS 2006a). BMPs consist of road design requirements and construction techniques to minimize sediment discharge to streams, lakes, and wetlands, as well as standards for maintaining road stability to control erosion (Region 2 Soil and Water Conservation Handbook 2509.25; BMPs 13.3, 13.4 and 13.5; USFS 2006a). USFS BMPs are typically more restrictive than those applied to BLM lands, and as a consequence the potential for impacts to watershed resources (from spills, etc.) would be lower on NFS lands.

Each of the alternatives represents a major increase in ground-disturbing activities (roads, well pads, etc.) relative to the No Leasing Alternative (Table 3.6.11) and would result in impacts to surface water resources. The differences between the alternatives come in two major categories. First, special lease stipulations vary by alternative, and second, acres of disturbance vary by alternative.

Alternatives B and C have more restrictive stipulations relative to Alternatives A and D, disturb fewer acres, and would have a lower level of impacts to surface water resources. Variations in stipulations between Alternatives B and C include Alternative C being more restrictive of development in municipal supply watersheds and intermittent/ephemeral streams, on steep slopes and shale, or on gypsum soils. These factors, combined with fewer acres of disturbance, mean that Alternative C would have the lowest impacts to surface water resources, followed by Alternative B, then A and D.

Table 3.6.11: Total Acres of Disturbance for Wells on Currently Leased and Unleased Federal Lands in the Paradox Leasing Analysis Area, All Wells Conventional and Shale Gas

Alternative		Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
USFS	Leased	530	530	530	530	530
	Unleased	3,040	2,865	2,240	3,025	0
BLM	Leased	1,780	1,780	1,780	1,780	1,780
	Unleased	1,290	908	810	1,140	0
Total		6,640	6,083	5,360	6,475	2,310

Cumulative Impacts

The cumulative impacts analysis described herein is for the period of expected LRMP implementation (which is 10–15 years) and is bounded by the 6th-level HUC boundaries associated with the federal lands discussed in this FEIS. (An example of the size of a 6th-level HUC would be roughly the size of Hermosa Creek or the Piedra River watersheds.) Looking past the boundaries of the planning area in order to consider how the direct and indirect impacts of management activities would cumulatively add to downstream water quality, the most important consideration is that the headwaters of streams and rivers are located on public lands. With the exception of some lands in the upper Animas River watershed and in the northwest portions of the planning area, there are no water courses that originate on private lands that flow into the planning area.

Watershed cumulative effects include the total impacts of runoff, erosion, sediment or water yield, and water quality that results from the incremental impact of a Proposed Action when added to other past, present and reasonably foreseeable future actions occurring within the same natural drainage basin or watershed. This analysis includes not only development on the federally managed lands, but also state and private lands.

The largest potential for cumulative impacts to watershed resources in the planning area comes from development in the PLAA. In addition to development on the federal mineral estate, approximately 2,500 acres are projected for ground surface disturbance from oil and gas activities on state and private lands. Potential impacts to surface water resources would be the same as on lands administered by the SJNF and TRFO, and would be the same for all alternatives. Consequently, the differences in the cumulative effects between Alternatives A through D would result from differences in development on the federal mineral estate.

The potential cumulative effects on surface water resources from gas development are the same as those discussed in the analysis of the direct and indirect effects. Additional development on private and state lands, without appropriate management of both road density and construction techniques, would result in increased erosion and sedimentation. These problems would likely occur in watersheds, and on soils, that could create conditions that are contrary to the desired outcomes of the Colorado Basin Salinity Control Act of 1974.

The potential cumulative effects on groundwater resources from gas development are the same as those discussed in the analysis of the direct and indirect effects (effects from future development on lands currently leased), consisting of reduced groundwater quantity due to consumptive use during well drilling, well completion, and well operation, and reduced water quality due to hydraulic fracturing, subsurface reinjection, and surface spills of produced water or flow back fluids.

Water used for well drilling, completion, and operation on the federal mineral estate is assumed to come from off-site. Due to the lack of specific project proposals, the effects on groundwater resources on federal lands are unknown. However, water used for these operations on state and private lands would likely come from ground or surface water sources within the planning area. The withdrawal of groundwater resources from the planning area has the potential to place pressure on existing domestic, municipal, and agricultural groundwater uses at a time period when municipal demand for water is expected to grow (CWCB 2010).

Based on the analysis in the direct and indirect section, the cumulative effects on water resources (ground and surface) of Alternatives B and C would be similar, with Alternative C likely having fewer impacts. The cumulative effects of Alternative A and D would be similar in type, but greater in

magnitude than those of Alternatives B and C because Alternatives A and D project the greatest amount of acres of disturbance with fewer mitigation measures.

3.7 Livestock and Rangeland Management

3.7.1 Introduction

Domestic livestock grazing has occurred on public lands within the planning area since the late 1870s (O'Rourke 1980). The livestock industry, comprising mostly ranching families, has been an integral part of community development, as well as overall lifestyle, in southwest Colorado. Public lands supply winter, spring, and summer grazing for dependent livestock producers and represent a significant portion of their total operations. Generally, term grazing permits are issued for 10 years to qualified producers, allowing grazing on designated areas or allotments. Permit holders or grazing permittees pay an annual fee for the privilege of using public land forage. They are also required to abide by the terms and conditions of the grazing permit. These terms and conditions address livestock and land ownership, range improvement construction and maintenance, and required livestock management practices. Most permitted livestock spend approximately 4 months of the year on public lands, although permittees who have grazing permits for both NFS and BLM public lands may be permitted to use public lands for a longer period of time. Day-to-day public land grazing administration is delegated to local District Rangers and Field Office Managers. Implementation of required management practices and long-term impacts related to grazing are monitored. As necessary, adjustments are made in order to ensure compliance with the terms and conditions of grazing permits, as well as to maintain or improve long-term public land health.

Legal and Administrative Framework

Requirements from the following list of policy, law, and other direction would apply to management of livestock grazing and rangeland and would mitigate the potential impacts of management activities:

- BLM grazing regulations at 43 CFR 4100
- BLM Colorado Public Land Health Standards
- BLM IMs and Bulletins related to the agency livestock grazing management program
- USFS grazing regulations at 36 CFR 222
- USFS range management manual direction at FSM 2200
- USFS grazing permit handbook direction at FSH 2209.13
- USFS Watershed Conservation Practices Handbook, FSH 2509.25
- Standards and guidelines displayed in the LRMP

3.7.2 Affected Environment

Existing Conditions and Trends

Public grazing lands are used by 101 USFS and 64 BLM grazing permittees. Of these grazing permittees, 13 have grazing privileges on lands administered by both agencies. Grazing use for each allotment is assigned in terms of AUMs. An AUM is the amount of forage needed to sustain one cow, five sheep, or five goats, for a month. Allotments on the SJNF and TRFO support a total of 132,464 AUMs (Table 3.7.1). Table 3.7.2 shows the status of grazing allotments in the planning area. The grazing season on TRFO lands is usually fall, winter, or early spring, with the exception of seven

sheep allotments in the Silverton area that are only grazed during the summer. SJNF lands are generally grazed during the summer.

Table 3.7.1: Current Active AUMs on Lands Administered by the San Juan National Forest and Tres Rios Field Office

Livestock Class	USFS	BLM	Total
Cattle	102,925	21,070	123,995
Sheep	6,396	2,073	8,469
Total	**109,321**	**23,143**	**132,464**

Table 3.7.2: Grazing Allotment Status

Allotment Status	USFS	BLM	Total
Active	99	85	184
Vacant	25	38	63
Other	3	0	3
Total	**127**	**123**	**250**

Less than one-half of the SJNF is under permit for livestock grazing, which is a slight decrease from when the current LRMP was approved. This is mainly due to decreased demand for sheep grazing on the SJNF, as well as opportunities taken to resolve resource conflicts over the years using vacant allotments. Over the last several decades, forage demand on public lands has remained constant. However, market factors, predator-control issues, and federal government policies eliminating wool subsidies have resulted in a significant reduction in sheep numbers.

Acres of rangelands suitable for livestock use have decreased by about 20% due to closure of sheep allotments. The overall trend appears to be in an upward direction as greater than 65% of rangelands and about 60% of riparian areas are meeting or moving towards current LRMP objectives. One of the major reasons for the improvement has been improved grazing management tied to effective timing of livestock grazing and establishment of effective grazing systems. In addition, large fires such as the 2002 Missionary Ridge Fire and the 2012 Little Sand Fire, as well as an ongoing bark beetle infestation, are restoring more diverse landscapes on the SJNF. The majority of areas not meeting objectives are within riparian areas, native meadows, and closed canopy timber stands due to lack of disturbance.

Range improvement practices used under the current LRMP to restore or maintain rangelands and riparian areas include but are not limited to managed fire for resource benefits, timber harvest, mechanical and biological treatments, chemical use to control invasive species, reseeding, structural range improvements, and improved livestock management practices. These practices would continue under the new LRMP. Table 3.7.3 displays range conditions and trends on lands suitable for livestock use on the SJNF. Acres include areas closed to grazing In order to provide a better overall assessment of range conditions.

Table 3.7.3: Range Trends on Lands Suitable for Livestock Grazing (San Juan National Forest)

Trend	Rangelands		Riparian Areas	
	Acres	Percentage	Acres	Percentage
Verified meeting LRMP objectives	713,893	46	18,531	34
Estimated meeting LRMP objectives	166,761	10	7,030	13

Trend	Rangelands		Riparian Areas	
	Acres	Percentage	Acres	Percentage
Subtotal	**880,654**	**56**	**25,561**	**47**
Verified moving towards LRMP objectives	55,337	4	1,070	2
Estimated moving towards LRMP objectives	108,998	7	5,704	10
Subtotal	**164,335**	**11**	**6,774**	**12**
Verified not meeting LRMP objectives	56,883	4	1,158	2
Estimated not meeting LRMP objectives	19,273	1	2,484	5
Subtotal	**76,156**	**5**	**3,642**	**7**
Undetermined status	428,082	28	18,522	34
Total Acres	**1,549,227**	**100**	**54,499**	**100**

Implementation of the eight BLM Colorado grazing guidelines has helped move rangelands on the TRFO towards meeting BLM Colorado rangeland health standards. These guidelines include deferring livestock grazing on a regular basis during the critical growing season to promote perennial grass maintenance, allowing for adequate regrowth and recovery, and allowing an opportunity for seedling establishment. Table 3.7.4 displays the status of BLM rangelands in making progress towards meeting BLM Colorado rangeland health standards.

Table 3.7.4: Rangeland Health Status within the Tres Rios Field Office*

Acres Meeting or Making Progress towards Meeting Standards	Acres Not Meeting, but Appropriate Action Has Been Taken to Ensure Significant Progress towards Meeting Standards (livestock a significant factor)	Acres Not Meeting Standards and Livestock Are Not a Factor
155,043	226,525	8,431
*196,418 acres on the TRFO were not assessed and are not included in this table.		

Suitability of Lands for Livestock Grazing

The NFMA and the 1982 USFS planning regulations require that NFS lands be identified as suitable or unsuitable for livestock grazing. The BLM Land Use Planning Handbook requires that BLM lands be identified as available or unavailable for livestock grazing. In this FEIS, suitability and availability are synonymous, and the term “suitable” is used to describe the SJNF and TRFO where livestock grazing is allowed to occur. Using the process described in the BLM’s Land Use Planning Handbook and the USFS Region 2 Desk Guide, a suitability analysis was conducted. It provides a determination of areas generally suitable for livestock grazing. Lands suitable for grazing are lands with vegetation that can be used by grazing animals, both domestic and wild herbivores, without damage to the soil and water resource values. Table 3.7.5 displays current grazing suitability by livestock class for the SJNF and TRFO. Maps 8 through 11 (Volume III, Appendix V) depict SJNF and TRFO lands suitable and unsuitable for cattle and sheep grazing, by alternative.

Table 3.7.5: Lands Currently Suitable for Livestock Grazing

Livestock Class	SJNF		TRFO	
	Acres	% of Land Base	Acres	% of Land Base
Cattle	689,628	34%	300.828	60%
Sheep	183,733	10%	9,031	2%

Management Indicator Species

The SJNF has identified four MIS: elk, American marten, hairy woodpecker, and Abert's squirrel. Winter range is the limiting factor for elk. Livestock grazing occurs in most identified elk winter range areas. Winter range habitat maintenance and improvement would be accomplished through appropriate rotational grazing systems, managing for forage regrowth, habitat improvement projects, and limited livestock use of browse species later in the grazing season so that preferred browse species are available to wintering elk. American marten occupy mid to late seral spruce fir and cool-moist mixed conifer habitats. Suitable livestock grazing acres are limited in these vegetation types due to lack of livestock forage caused by closed canopies. Livestock grazing impacts would be directly related to the American marten's prey base. However, as livestock forage is limited within American marten habitat any direct impacts would be minimal. Hairy woodpeckers are cavity nesters and prefer dense canopies in coniferous and deciduous forests. These areas are usually unsuitable to secondary ranges and are not generally preferred by livestock. Therefore, managed livestock should not adversely impact hairy woodpeckers. Abert's squirrels are dependent on ponderosa pine—specifically mid to late seral conditions. As long as livestock grazing practices do not limit fine fuel accumulation and do not impact ponderosa pine regeneration, there should be limited impacts from livestock management.

Livestock Grazing and Rangeland Trends

The following discussion highlights ongoing and possible future trends in livestock grazing and rangeland management across the planning area.

<u>Rangeland Management</u>

Management directed at improving and maintaining rangeland health would continue. Overall livestock numbers may remain stable; however, adjustments could occur through allotment management plans and/or annual operating instructions in order to resolve resource problems at the project level or increase based on available forage.

<u>Ongoing Drought</u>

Should the current drought continue, rangeland productivity would continue to decline, which in turn would require management adjustments through allotment management plans and/or annual operating instructions. Over time, these adjustments (including reduced livestock numbers and modified grazing seasons) may become permanent. In addition, permanent unfavorable changes to rangeland vegetation, such as cheatgrass invasion into healthy rangelands, could also occur, which could also require permanent livestock management changes. The new LRMP provides management direction for future spread of invasive annual weed species through desired conditions and objectives.

Decline in Investments for Structural Range Improvements

Earlier RMPs called for substantial investments in range improvements including fences, reservoirs, and vegetative manipulations. At present, the majority of desired structural infrastructure is in place. Declining budgets, combined with other market factors (including high land prices and continuing loss of rural lands to development), as well as potential resource conflicts, may make additional investments (outside replacement costs) in range structural improvements increasingly unattractive. However, investment in non-structural range improvements such as fuel reduction projects, seeding, and noxious weed control should continue, as they are cost effective and provide multiple resource benefits.

Forage Competition between Domestic Livestock and Big Game

Forage competition between domestic livestock and big game would continue to increase. As more private land is developed and more habitat is impacted on private lands, there would be less available forage overall. Reducing forage conflicts may require changes to livestock numbers and grazing seasons. The LRMP direction for rangeland management and the monitoring plan address the need to consider forage conflicts.

Loss of Open Space

Private ranchlands provide significant wildlife habitat, including critical big game winter range, by maintaining large areas of open space. As the rate of private land development increases, both regionally and locally, there would be a net loss of agricultural lands. This means management options designed to address resource conflicts could decrease over time. This trend would require public land management agencies to revisit the current base property requirements necessary to hold a federal grazing permit. Over the last 5 years, there has been an increasing use of conservation easements designed to limit development on private lands in order to preserve open space. Should this trend continue, the rate of loss of agricultural lands may be slowed. These conditions would continue to be monitored during implementation of the LRMP.

Demand for Federal Grazing Privileges

Due to the reasons previously discussed, demand for federal grazing permits may increase as a result of the loss of private agricultural lands capable of supporting livestock. This issue would be monitored during implementation of the LRMP.

Demand for Red Meat

Due to population increases, overall beef consumption is expected to continue to increase.

Demand for Wool and Sheep

The demand for these products has been declining over the years. However, based on the use of sheep for weed-control work, an improved wool market, and an improved competitive stand with the rest of the world’s wool-producing countries, demand may increase.

3.7.3 Environmental Consequences

Direct and Indirect Impacts

Under Alternatives A and B, changes to livestock grazing management would generally be minor in that permitted AUMs would only change by approximately 2% from Alternative A to B (see Table

3.7.6). Alternative A would propose to continue current permitted livestock levels. Alternative B would propose to slightly increase permitted AUMs by combining several vacant custodial BLM allotments with active BLM allotments in the maintain category and continuing to offer other BLM allotments in the maintain category while eliminating permitted AUMs on vacant custodial BLM allotments. Three currently vacant USFS allotments would be offered through the grant process. Alternative C would be the most restrictive alternative in that livestock grazing would be managed in order to enhance wildlife, cultural, and soils values, which would result in lower stocking rates (see Maps 8–11 [Volume III, Appendix V] for comparative stocking rates by alternative). This is because several vacant USFS sheep allotments would be permanently closed to livestock grazing, and BLM sheep allotments in the Silverton area would be closed to livestock grazing to eliminate potential wild and domestic sheep conflicts. The BLM Spring Creek allotment located within the Spring Creek Wild Horse HMA would be closed to livestock grazing to promote soil and vegetation improvement and move resource conditions closer to meeting Colorado BLM rangeland health standards, and custodial BLM allotments would be closed to livestock grazing to improve public land management efficiency. Alternative D would propose to increase livestock grazing by offering vacant USFS allotments to qualified operators, increasing stocking rates via restoration activities on BLM allotments in the improve and maintain categories where rotational grazing systems are in place, maintaining stocking levels on BLM allotments elsewhere, and increasing AUMs on USFS grazing allotments within those areas where restoration activities are planned.

Table 3.7.6: Estimated AUMs by Alternative

Livestock	Alternative A	Alternative B	Alternative C	Alternative D
Cattle	123,995	126,961	107,791	163,479
Sheep	8,469	8,469	4,997	13,608
Total	**132,464**	**135,430**	**112,788**	**177,087**

Lands suitable for livestock grazing would also change by alternative (Table 3.7.7). Generally, lands suitable for grazing would be similar under Alternatives A and B. Alternative C, however, would implement major changes in lands suitable for sheep grazing, as well as minor changes in lands suitable for cattle grazing by reducing the amount of overall suitable grazing lands. Alternative D would implement a major increase in lands suitable for sheep grazing and a minor increase in lands available for cattle grazing. Alternative D, when compared to the other alternatives, would provide the most suitable grazing lands; Alternative C would provide the least suitable grazing lands.

Table 3.7.7: Suitable Grazing Acres by Alternative

Livestock	Alternative A	Alternative B	Alternative C	Alternative D
Cattle	990,456	982,849	879,962	1,110,446
Sheep	192,764	192,764	123,703	192,764

Differences in suitable grazing lands may also be used to estimate potential livestock grazing impacts to other resources, including riparian areas and wildlife habitat. Alternative D, followed by Alternatives A, B, then C, would provide the most suitable acres of livestock grazing; thus, the potential for livestock grazing impacts may be the most significant under Alternative D and least significant under Alternative C. It would be reasonable to assume that under Alternative D, livestock management, including grazing permittee management involvement, would need to be more intensive and may require more investments in range improvements such as fencing, vegetation manipulation, and water developments, in order to avoid or mitigate potential impacts to other resources. Alternative C would provide the most opportunity to remedy livestock grazing conflicts with other resources

because livestock grazing would occur on fewer acres of public land and stocking rates would be the lowest than under any other alternative. Specific changes to allotment management practices, regardless of the alternative chosen, would be made at the project level.

LRMP components for livestock grazing as displayed in the LRMP would be the same under Alternatives B, C, and D and would change from the current plan (Alternative A). Livestock grazing suitability differs by alternative. Under Alternative B, acres of suitable grazing lands would decrease 3% on BLM lands due to closure of vacant custodial BLM lands and would not change on NFS lands. Under Alternative C, acres of suitable grazing lands for cattle would be 93% of what is currently suitable on the SJNF and 79% of what is currently available on the TRFO; acres of suitable grazing lands for sheep would be 67% of what is currently available on the SJNF and 11% of what is currently available on the TRFO. These changes are mainly due to closure of certain sheep allotments on all public lands and closure of all BLM custodial allotments. Under Alternative D, acres of suitable grazing lands for cattle would increase by 16% and 3% for NFS and BLM public lands, respectively, and remain the same as Alternatives A and B for suitable grazing lands for sheep. The increase in suitable cattle acres would mainly be as a result of more grazing allotment availability.

General Impacts

Since the early 1920s, permitted livestock grazing on public lands has decreased. Since the 1980s, however, livestock numbers appear to have stabilized. Increasing demands for other public land uses, as well as changes in the market and in the use of surrounding private lands, may account for the long-term decrease. Grazing permittee involvement and commitment to meeting public land goals and objectives is critical to maintain current stocking levels. Overall, demand for public land grazing privileges remains strong, especially for cattle allotments.

Monitoring indicates that there are areas where MA direction is not moving rangelands toward desired conditions. Objectives, standards, and guidelines addressing livestock management in the revised LRMP would provide management direction needed to move rangelands towards desired conditions. Therefore, it is possible that as project-specific grazing decisions are implemented, downward changes in permitted use could occur in order to reach sustainable stocking levels.

Permitted livestock grazing, along with the combination of vegetative treatments designed to improve rangeland health (including aspen management, seeding native species, and prescribed and natural fires) would all contribute to moving rangeland vegetation toward desired conditions. In contrast, current trends in motorized recreation, the current lack of fire in fire-adapted ecosystems, current increases in noxious weed populations, and livestock management occurring outside prescribed guidelines may move rangeland vegetation away from desired conditions. It is expected, however, that conditions should improve in the long term as livestock management is brought into compliance and the new LRMP is implemented.

Impacts from Fire and Fuels Mitigation

Under LRMP objectives an average of 13,000 acres would be treated annually using a combination of mechanical fuels treatment and prescribed fire, and approximately 3,000 acres of fire-related treatments are projected using wildland fire use fires. These methods and objectives are consistent across alternatives.

Generally, earlier seral conditions favorable to production of grasses and forbs would be maintained or even increased in some areas due to LRMP fire management activities and some mechanical fuels treatments. Managed fire and fuels projects may result in increased availability of forage in the long

term. The potential for forage allocation increases (AUMs) is a factor that contributes to the higher livestock grazing objectives in Alternative D. Fire and fuels projects planned in unsuitable rangelands would generally have little beneficial effects.

While wildfire can be beneficial due to changes made to vegetation structure through removal of trees and brush, nutrient recycling, and a subsequent increase in forage production, it can also destroy natural boundaries, fences, and other range improvements, and cause additional environmental impacts such as burned soils that necessitate removal of livestock for some time in order to ensure recovery takes place. These effects, regardless of alternative, can increase costs to grazing permittees as they are forced to find other forage sources, and the effects can increase costs to both the government and grazing permittee due to range improvement replacement costs.

Generally, effects to vegetation result in at least a short-term forage production improvement. Provided that projects are retreated to maintain desired vegetation conditions, managed fire and fuels projects could result in increased availability of forage in the long term. Secondary beneficial effects would be improved livestock distribution, improved riparian condition, suitable acres for livestock maintained, and overall management flexibility improved. The most benefit to livestock grazing due to fire and fuels management would be realized under Alternative D, because more livestock grazing would be authorized, followed by Alternatives B, A, and C.

Impacts from Minerals Management

Uranium development in the Dove Creek/Slickrock area could be a major solid minerals activity in the coming years. Other minor development, such as gravel pits, would take place across the SJNF and TRFO with lower levels of disturbances. This level of development would occur under all alternatives. If projects are approved the effects to livestock grazing would depend on where disturbance occurs and when the activity would be reclaimed. If the disturbance occurs on suitable grazing lands on active grazing allotments, there could be a short-term loss of AUMs, although the amount would be negligible under current stocking rates. As all ground-disturbing activities are required to be reclaimed, long-term AUM loss should not occur. Other short-term impacts such as the need for gates or cattle guards due to increased traffic would be mitigated through leasing and operating stipulations.

Long-term adverse impacts from minerals management activity decisions would occur only when vegetative reclamation activities are unsuccessful. This would provide a risk for invasive species establishment, increased soil loss, and reduced forage production potential. When reclamation is successful, then opportunities for invasive species establishment and soil loss would be lessened, while forage production should increase. As the amount and rate of minerals development is predicted to be the same across alternatives, there would be little net change between alternatives.

No oil and gas leasing stipulations have been developed specifically for livestock management and production. Lands cleared for oil and gas development and operations in the planning area could result in short-term forage loss. The effects of oil and gas leasing and development to livestock grazing would depend on where disturbance occurs, development density, and when disturbed areas are reclaimed. If disturbance occurs on suitable grazing lands on active grazing allotments, there may be a short-term loss of AUMs. However, given current stocking rates, the AUM loss would be minimal. BMPs would be applied as conditions of APD approval and include reconstructing range improvements where impacted by oil and gas development, installing cattle guards, partially reclaiming cleared sites using desirable grass species, and implementing other practices as prescribed to minimize impacts to livestock. Disturbed areas would undergo partial reclamation efforts following facility construction and full restoration following the useful life of the well and would restore loss of forage.

Table 3.7.8 summarizes acres of disturbance projected for leased and unleased lands for conventional and GSGP activities within the PLAA by alternative. Impacts are displayed as a range of foregone AUMs, based on light to high stocking densities, by alternative. AUMs are used as a comparison metric. For analysis purposes, all disturbance is assumed to have occurred on suitable cattle grazing lands. Any changes to permitted livestock grazing due to oil and gas development would be decided when field development plans are evaluated. For those acres remaining unleased there would be no disturbance due to oil and gas leasing and thus no AUM loss.

Table 3.7.8: Acres of Disturbance Projections by Alternative on Leased and Unleased Lands and Associated AUM Losses for the Conventional and Gothic Shale Gas Play area within the Paradox Leasing Analysis Area

Alternative	Acres of Disturbance	Foregone AUMs	Percentage of Planned Grazing by Alternative
A	6,640	440–2,200	<1%–2%
B	6,083	400–2,000	<1%–2%
C	5,360	360–1,800	<1%–<2%
D	6,475	430–2,100	<1%–<2%

Alternative D leasing decisions followed by leasing Alternatives A, B, and C, respectively, could affect the greatest number of AUMs and suitable rangelands. Overall, AUM loss would be minor, as less than 2% of permitted AUMs by alternative would be affected. Leasing Alternative A, followed by Alternatives D, B, and C, would have the greatest number of well pads and access roads, and consequently, the highest potential to produce AUM impacts. No suitable rangelands would be affected under the No Leasing Alternative on unleased federal lands.

Impacts from Management of Research Natural Areas

Existing and proposed RNAs are located only on the SJNF. The major direct effect to livestock grazing due to new RNA designations would depend on whether livestock grazing could occur within the RNA. The decision to graze is made when RNA management plans are completed and approved by the appropriate Forest Officer. Should grazing not be allowed for proposed RNAs, there could be a potential loss of AUMs. AUM loss could be tempered or exacerbated by vegetation conditions and the characteristics of the grazing system within the allotment(s) containing the RNA.

Rangeland suitability may be impacted where livestock grazing is proposed to be reduced or eliminated due to RNA establishment. Should natural disturbances such as fire and insect outbreaks not be allowed to occur, then natural succession would move towards later seral stages resulting in long-term decreased forage production. These effects could be mitigated if individual RNA management plans allow for disturbance activities such as fires to maintain herbaceous cover and production.

Table 3.7.9 displays suitable acres that overlap with RNAs by alternative and the potential AUM loss considering current class of livestock use on NFS grazing allotments. Overall, reductions in AUMs are minor and some AUM losses for sheep are in allotments proposed to be closed under Alternative C. Alternative C, followed by Alternative B, has the greatest potential to result in a reduction in AUMs.

Table 3.7.9: Potential AUM Loss Due to New Research Natural Area Designations

Alternative	Suitable Sheep Acres within RNAs	Potential Loss of Sheep AUMs	Suitable Cattle Acres within RNAs	Potential Loss of Cattle AUMs
A	0	0	0	0
B	2,135	151	906	102
C	13,409	951	906	102
D	18	1	0	0

Impacts from Wilderness Management

Wilderness areas are managed to protect wilderness characteristics. Direction contained in Congressional grazing guidelines dictates that livestock grazing in wilderness areas would be permitted to continue when such grazing was established prior to an area being classified as wilderness (USFS 2007d). In addition, the same guidelines provide that wilderness designation not preclude range improvement construction and maintenance that is consistent with allotment management plans and/or needed to protect rangelands.

Livestock management in wilderness areas would be more difficult and costly than on other public lands as motorized access and equipment are restricted, and there may be other restrictions on new range improvement designs that could be more costly.

Some indirect effects include:

- increased public expectation of no livestock presence within wilderness areas by visitors;
- the need to manage around a recreational “wilderness” experience expected by visitors, especially those areas currently not designated wilderness, but may be in the future;
- the need to manage for wilderness character and plant communities; and
- the difficulty of administering grazing permits due to motorized travel restrictions.

Alternative D would allow the most livestock grazing—primarily sheep—in wilderness areas followed by Alternatives A, B, and C. Alternative D proposes to offer certain vacant sheep allotments for permitted livestock grazing, some of which could be located within wilderness areas, while Alternative C effectively closes currently vacant sheep allotments and closes active sheep allotments in the Silverton area.

Impacts from Timber Management

Timber harvest would open the canopy so that an increase of forage occurs in the understory. This forage increase is considered temporary, and the term “transitory range” is used to describe this result. Over time forested stands would once again close in or young trees become dense enough that the increased rangeland vegetation no longer is available on-site. The use of transitory range can be beneficial in improving livestock distribution in the short term.

Timber harvest may also result in the removal of natural livestock barriers. Fence construction would be required to maintain these barriers. In addition, there may be a need to construct new gates and/or cattle guards to accommodate harvest activities.

An indirect effect of aspen harvest is that once stands close in they become virtual barriers to livestock movement. This affects livestock distribution and management until aspen are naturally thinned over time. Alternative D has objectives to harvest the most aspen followed by Alternative B. Alternatives A and C have objectives to harvest the least amount and acreages are identical.

Permitted livestock are not expected to increase due to the temporary increase in transitory range. The greatest amount of transitory range would be created in Alternative D, followed by Alternatives A, B, and C, based on timber harvest objectives by alternative.

Impacts from Wildlife and Fisheries Management

Wildlife management activities that may result in effects to livestock grazing include:

- **Effects from big game management decisions:** Forage demands from big game can exceed the capability of the land and cause detrimental impacts to soil and vegetation. Conflicts over allocation of forage between livestock and big game are ongoing and could increase if big game populations increase. In some cases this could result in limitations on permitted livestock use through changes in grazing seasons and/or livestock numbers.
- **Sage-grouse management decisions:** Allowable livestock forage use and grazing season could be affected on those grazing allotments where sage-grouse is present and where habitat needs are not being met. These effects would be greatest on those grazing allotments managed without some form of pasture rotation. There are no differences between alternatives for impacts from sage-grouse management.
- **Bighorn sheep management decisions:** The need to avoid contact between domestic and bighorn sheep could result in removal of domestic sheep and grazing allotment closures to domestic sheep use. Alternative C would mitigate this concern most effectively as vacant sheep allotments along with active sheep allotments in the Silverton area would be closed. The other alternatives would all allow for some domestic sheep grazing within bighorn sheep range. However, interaction between bighorn and domestic sheep could not occur, which could greatly impact management of sheep allotments.
- **Wildlife and fisheries management decisions:** Management may involve but not be limited to adjusting grazing time, intensity, and timing of livestock use, and/or livestock exclusion, fencing, and range improvements where livestock use adversely impacts upland and riparian vegetation. Decisions to change livestock management would be made at the project level using planning components in the LRMP under Alternatives B, C, or D and existing direction provided in Alternative A.
- **Threatened/Endangered/Sensitive species management decisions:** Habitat for threatened, endangered, and sensitive species would be protected, maintained, or increased. These actions may require changes in livestock management through changes in grazing strategies, grazing use, and range improvement use and design. Conservation strategies, critical habitat designations, and BOs address specific management requirements.

Impacts from Travel and Recreation

Public lands roads and trails are used by grazing permittees to manage grazing activities within allotments. These same roads and trails are used by public lands visitors and other permit holders for a variety of uses other than livestock management activities resulting in the potential for conflict.

Generally management costs are reduced for grazing permittees having access to allotments along open public land roads. While management efficiency may be improved, increased access by visitors can create additional management problems such as gates being left open, livestock disturbance, and vandalizing of cow camps and range improvements. There are also potential benefits as different public lands users become acquainted with various valid uses of public lands.

Recreation use in and of itself would generally have little impact to rangeland vegetation, except in those areas that receive repeated and continued uses such as camping areas, hiking trails, and OHV use. These activities, if conducted in a manner that promotes soil loss and compaction, could adversely affect rangeland vegetation by moving vegetation conditions to an earlier seral stage and away from desired conditions. Implementation of the LRMP should mitigate most adverse impacts through implementation of standards and guidelines designed to protect soil and vegetation and by limiting motorized, recreational travel to designated roads and trails. Overall, livestock management should benefit with implementation of the 2005 travel management rule, which allows continued motorized access to grazing allotments using existing routes. Alternative C restricts summer motorized travel the most, while the other alternatives are relatively similar. Winter travel restrictions should not impact livestock management activities.

Cumulative Effects

Past Effects

Effects from historic livestock use on the SJNF and TRFO continue to be evident and influence livestock management today. Historic livestock numbers, for both sheep and cattle, were higher in the past than at present. Higher stocking densities without today's investments in range improvements, such as fences and water developments, resulted in soil and vegetation degradation in those areas preferred by livestock such as riparian areas. Generally, unrestricted or longer grazing seasons adversely impacted native upland vegetation by not allowing adequate grazing recovery periods. This resulted in the replacement or decrease of some native bunchgrasses, such as Parry's oatgrass and Arizona fescue, with less desirable species such as Kentucky bluegrass. Overall potential productivity decreased with unrestricted grazing practices. These conditions have gradually been improved using improved livestock management practices along with shorter grazing seasons and reduced permitted livestock on public lands.

Past fire suppression activities have resulted in conifer encroachment into formally suitable grazing lands, which limits forage productivity and availability. This has also affected livestock use and distribution patterns. Past timber harvest, especially in higher-elevation spruce/fir, increased available transition range.

Current Effects

Permitted livestock numbers should remain stable and the demand for grazing privileges is expected to remain high for cattle allotments. The sheep market is expected to continue its decline; however, the number of sheep permittees is expected to remain stable. Ongoing livestock management practices to mitigate drought impacts are continuing.

Improved management such as fencing and water developments has helped arrest soil and vegetation degradation. In addition, knowledge of the appropriate timing and grazing intensity has improved livestock management on public lands. Drought impacts to rangeland vegetation are continuing. There are still livestock stocking issues and management concerns on some grazing allotments; however, these issues are addressed at the project level.

Ongoing timber harvest and fuels management are creating increased transitory range. This is an overall benefit to livestock management, as these activities should increase management flexibility and livestock distribution as long as they continue. There would continue to be impacts to rangeland vegetation from fire suppression, noxious weed management, livestock and big game grazing, recreation use, and other vegetative management activities. Some activities would result in positive

effects, while other activities such as fire suppression and unmanaged recreation could result in unfavorable effects. In general, those activities that move or keep rangeland vegetation in a range between early and mid-seral conditions would be beneficial.

Forage competition between big game and livestock would continue as big game numbers continue to increase and more acres of private land are converted to non-agricultural uses.

Agricultural land prices are increasing and may be out of reach for those buyers intending to continue agricultural uses on purchased lands. This could adversely impact grazing permittees needing to acquire additional lands to manage around the requirements of public lands grazing, and also make it more difficult for those wanting to enter the livestock business. The use of conservation easements to maintain open space may increase, which would reduce the conversion rate of agricultural lands to other uses.

Foreseeable Effects

Livestock grazing under improving management systems should continue on public lands; however, the demand for grazing privileges would depend on the ability of current and future grazing permittees to absorb increasing operating costs.

As land values continue to increase, some grazing permittees would likely choose to sell their land for conversion to other uses. Significantly reduced levels of livestock grazing could have adverse effects such as the loss of privately owned open land and the change in local customs and culture. Loss of grazing would also result in the loss of grazing as a vegetation management tool. However, in those areas where vegetative condition is not meeting desired conditions, no grazing could result in an improvement in these conditions.

Fuels and fire management decisions in the LRMP should continue to increase the amount of transitory range, which would remain a benefit.

Solid minerals management activities would continue to remain stable. Fluid minerals activity is expected to increase as lands are made available for lease. These activities could be mitigated through range improvements such as new fences, seeding, and noxious weed control. Needed livestock management changes would be on an allotment-by-allotment basis.

Conflicts between grazing permittees and other public lands users are expected to continue and possibly increase as the amount of recreation, especially motorized uses, continues to increase. Impacts to rangeland vegetation would also continue to increase with growing recreation demand related to increases in local community populations through retirement and relocation of baby boomers and others who prefer motorized recreation experiences on public lands. Associated activities such as dispersed camping, hiking and biking could also impact rangeland vegetation. In addition, there could continue to be adverse impacts due to an ongoing drought, which would further restrict forage availability and land health. It is expected that cheatgrass would continue to expand on the SJNF and TRFO due to the ongoing drought.

Forage competition between big game and livestock would continue as big game numbers continue to increase and private land is converted to non-agricultural uses. As this trend continues changes in livestock management through reductions in permitted livestock numbers or seasons could be expected should soil and vegetation changes trend away from desired conditions.

3.8 Invasive Species

3.8.1 Introduction

Invasive species (noxious plants and aquatic nuisance species) can impact water quality, wildlife habitat, fisheries, forage production, and soil productivity. Invasive species can also displace native species. Noxious weeds and other invasive plant species establish as a result of ground disturbance and where a seed source is present. Weeds are introduced and spread in many ways, including by people, wildlife, vehicles, wind, water, and fire). The LRMP contains desired conditions, objectives, standards, and guidelines necessary to implement an integrated invasive species management program. Invasive species are currently managed using an invasive species action plan. The plan lists prevention practices, early detection and rapid response strategies, and priority inventory and treatment areas, and covers a 3-year timeframe. The action plan is reviewed annually and revised as necessary. All resource areas, such as the timber, recreation, and rangeland management programs, contribute to invasive species management.

Invasive species move across jurisdictional boundaries and property lines; therefore, implementation of the LRMP would involve close coordination and partnerships with local, state, tribal, and federal agencies, as well as with interested organizations and individuals.

Legal and Administrative Framework

The following references provide direction on implementation of the invasive species management program:

- Management and Control of Noxious Plants on the San Juan/Rio Grande National Forests, Decision Notice and Finding of No Significant Impact (USFS 1996)
- FSM 2900
- BLM Manual 9015
- Colorado Public Land Health Standards (BLM 1997)
- State Noxious Weed List (8 Code of Colorado Regulations 1203-10): The Colorado noxious weed list can be found at “Rules Pertaining to the Administration and Enforcement of the Colorado Noxious Weed Act”
- Integrated Weed Management Plan, BLM and SJNF (CO-800-2008-075 EA) (BLM 2011a)
- Vegetation Treatments Using Herbicides on BLM Lands in 17 Western States Programmatic Environmental Impact Statement (PEIS) (BLM 2007a)
- Vegetation Treatments on BLM Lands in 17 Western States Programmatic Environmental Report (BLM 2007b).
- Invasive Species Action for the San Juan National Forest, Tres Rios Field Office, and Canyons of the Ancients National Monument (USFS and BLM 2012)
- FSH 2509.25: USFS Watershed Conservation Practices Handbook (USFS 2006a)
- Standards and guidelines displayed in Volume II, LRMP

3.8.2 Affected Environment

Existing Conditions and Trends

A species is considered invasive if it is non-native to the ecosystem under consideration, and its introduction causes, or is likely to cause, economic or environmental harm or harm to human health (EO 13112). Weeds are legally designated as noxious by the Secretaries of the Interior or Agriculture or by the USDA. These noxious species usually result in significant crop damage, threaten livestock or human heath, and/or are particularly aggressive and difficult to manage.

The Colorado Department of Agriculture has three noxious weed designations: Class A (weeds targeted for eradication within the state), Class B (weeds that are to be managed for containment), and Class C (weeds, where optional, more intensive management can be undertaken by local organizations, such as by counties). There are 22 Class A, 39 Class B, and 15 Class C noxious weed species, for a total of 76 noxious weed species. There are also 20 additional species on a “watch list.” These are species that have been determined to pose a potential threat to the agricultural productivity and environmental values of the lands of the state.

The SJNF and TRFO have formal cooperative agreements with five of seven counties to treat, monitor, and inventory noxious weeds. In addition, the SJNF and TRFO have partnerships with other local entities, including the Dolores River Tamarisk Action Group, to support weed management.

Noxious weeds within the Weminuche, Lizard Head, and South San Juan wilderness areas are managed using an integrated approach of chemical, mechanical, and cultural methods. In 2004, the Regional Forester for Region 2 approved and extended a 2001 decision that included the limited use of herbicides in order to spot treat infestations of Canada thistle (*Cirsium arvense*), yellow toadflax (*Linaria vulgaris*), musk thistle (*Carduus nutans*), and houndstongue (*Cynoglossum officinale*). The related analysis also recommended continuing inventory and monitoring efforts in wilderness areas.

Table 3.8.1 displays noxious weed species and the state classification on the SJNF and TRFO.

Table 3.8.1: Noxious Weed Inventory on the San Juan National Forest and Tres Rios Field Office (acres)

Noxious Weed Species	Colorado Noxious Weed Classification	USFS	BLM	Total
Musk thistle (*Carduus nutans*)	B	23,811	3,405	27,216
Canada thistle (*Cirsium arvense*)	B	12,613	479	13,092
Russian knapweed (*Acroptilon repens*)	B	186	2,566	2,752
Houndstongue (*Cynoglossum officinale*)	B	2,663	13	2,676
Yellow toadflax (*Linaria vulgaris*)	B	1,522	178	1,700
Downy brome (Cheatgrass) (*Bromus tectorum*)	C	419	1,144	1,563
Oxeye daisy (*Chrysanthemum leucanthemum*)	C	1,216	4	1,220

Noxious Weed Species	Colorado Noxious Weed Classification	USFS	BLM	Total
Saltcedar (*Tamarix chinensis, T. parviflora, T. ramosissima*)	B	253	513	766
Spotted knapweed (*Centaurea maculosa*)	B	521	7	528
Common mullein (*Verbascum thapsus*)	C	365	37	402
Hoary cress (*Cardaria draba*)	B	37	191	228
Bull thistle (*Cirsium vulgare*)	B	178	2	180
Chicory (*Cichorium intybus*)	C	110	0	110
Leafy spurge (*Euphorbia esula*)	B	102	0	102
Dalmatian toadflax (*Linaria dalmatica, L. genistifolia*)	B	8	57	65
Quackgrass (*Elytrigia repens*)	C	54	0	54
Unknown	N/A	2	49	51
Scentless false mayweed (*Matricaria perforata*)	B	29	0	29
Field bindweed (*Convolvulus arvensis*)	C	28	0	28
Halogeton (*Halogeton glomeratus*)	C	0	25	25
Common teasel (*Dipsacus fullonum*)	B	18	0	18
Perennial pepperweed (*Lepidium latifolium*)	B	14	0	14
Scotch thistle (*Onopordum acanthium, O. tauricum*)	B	2	10	12
Diffuse knapweed (*Centaurea diffusa*)	B	6	0	6
Plumeless thistle (*Cardus acanthoides*)	B	5	0	5
Black henbane (*Hyoscyamus niger*)	B	5	0	5
Russian thistle (*Salsola tragus*)	N/A	1	4	5
Sulfur cinquefoil (*Potentilla recta*)	B	2	0	2
Perennial sowthistle (*Sonchus arvensis*)	B	2	0	2
Moth mullein (*Verbascum blattaria*)	B	2	0	2
Common St. Johnswort (*Hypericum perforatum*)	C	2	0	2
Cypress spurge (*Euphorbia cyparissias*)	A	1	0	1

Noxious Weed Species	Colorado Noxious Weed Classification	USFS	BLM	Total
Common burdock (*Arctium minus*)	C	1	0	1
Western whorled milkweed (*Asclepias subverticillata*)	N/A	1	0	1
Stinking (Mayweed) chamomile (*Anthemis cotula*)	B	1	0	1
Rush skeletonweed (*Chondrilla juncea*)	A	1	0	1
Mountain tarweed (*Madia glomerata*)	N/A	1	0	1
Kochia	N/A	0	1	1
Jointed goatgrass (*Aegilops cylindrical*)	B	1	1	1
Russian olive (*Elaeagnus angustifolia*)	B	1	<1	1
Corn chamomile (*Anthemis arvensis*)	B	<1	0	<1
Myrtle spurge (*Euphorbia myrsinites*)	A	<1	0	<1
Common tansy (*Tanacetum vulgare*)	B	<1	0	<1
Dame's rocket (*Hesperis matronalis*)	B	<1	0	<1
Absinth wormwood (*Artemisia absinthium*)	B	<1	0	<1
Total		44,185	8,685	52,870

Table 3.8.2 displays potential invaders that are on a “watch list.” The intent is to eradicate these species if found on public lands.

Table 3.8.2: Potential Noxious Weed Invaders on the San Juan National Forest and Tres Rios Field Office

Noxious Weed Species	Notes
Camelthorn (*Acacia erioloba*)	Found in southeast San Juan County, Utah, in the Montezuma Creek area; Class A
Yellow starthistle (*Centaurea solstitialis*)	Approximately 20 acres; found in Mesa and Montrose Counties; Class A
African rue (Peganum harmala)	Acreage greater than 50 acres; found in the Farmington, New Mexico area; Class A
Squarrose knapweed (*Centaurea virgata*)	Found in Utah; Class A
Orange hawkweed (*Pilosella aurantiaca*)	Found in northeast Colorado; Class A
Purple loosestrife (*Lythrum salicaria*)	Found along the San Miguel River; Class A
Medusahead (*Taeniatherum caput-medusae*)	Weed found in Nevada and Utah; Class A
Common soapwort	Found on private lands in Archuleta County, County Road 250 to East Animas

Noxious Weed Species	Notes
(*Saponaria officinalis*)	Road and around utility boxes; Class C
Giant salvinia (*Salvinia molesta*)	Aquatic weed; Class A
Hydrilla (*Hydrilla verticillata*)	Aquatic weed; Class A
Eurasian watermilfoil (*Myriophyllum spicatum*)	Aquatic weed; Class B
Perennial pepperweed (*Lepidium latifolium*)	Found close to the Montezuma/La Plata County lines and appears to be spreading easterly; Class B

The 1985 BLM San Juan/San Miguel Resource Management Plan (BLM 1985) does not address the issue of invasive species. The San Juan National Forest Land and Resource Management Plan (USFS 1983) provides the following invasive species guidance:

- Treat noxious weeds in the following priority:
    - Leafy spurge (*Euphorbia esula*) and Russian (*Acroptilon repens*) and spotted knapweed (*Centaurea maculosa*)
    - Invasion of new plant species classified as noxious farm weeds
    - Infestations in new areas
    - Expansion of existing infestations of Canada and musk thistle, and other noxious farm weeds
    - Reduction on acreage of current infestations

This direction has generally been followed; however, it is important to note that at the time both plans were written, invasive species management was believed to be primarily a range management problem.

New trends and needs have emerged, including:

- **The Missionary Ridge Wildfire of 2002:** This fire burned approximately 70,000 acres. The resulting noxious weed population doubled to approximately 6,200 acres. In spite of a 4-year contract to inventory and treat noxious weeds within the fire area, successful long-term management may continue to require large amounts of capital and labor.
- **Hazardous fuels program:** In spite of increased awareness regarding limiting the spread of noxious weeds in the planning area, ground disturbance may continue to provide a seedbed for new noxious weed infestations.
- **Increased awareness:** As the result of internal and external outreach and education, noxious weed impacts have evolved from a range management problem to a community problem. This awareness has produced cooperation between CPW and federal land management agencies, with the goal of restricting the use of uncertified hay on public lands within the state.
- **Integrated pest management:** Integrated pest management (e.g., cultural, mechanical, chemical, and biological control), as opposed to strictly herbicide treatment, has evolved over time.
- **New noxious weeds:** New noxious species are poised to invade public lands. These are described in Table 3.8.2 above. There was no analysis and direction regarding these species in the older LRMPs.

- **Increased legislative support to manage noxious weeds:** Several new laws, EOs, and initiatives have all resulted in raising awareness about invasive species.
- **Improved development and implementation of standard noxious weed mitigation measures in contracts and other agreements:** Noxious weed assessments are produced for every project and supporting NEPA analysis in order to outline the necessary mitigation measures for a proposed action on public lands.
- **Improved biological control methods:** There are approved biological control agents for leafy spurge, Canada thistle, musk thistle, Dalmatian toadflux (*Linaria dalmatica*), and yellow toadflax.
- **Improved herbicide formulations:** Over time, herbicide formulations have improved. This has resulted in less overall herbicides being used; however, control success rates have improved.
- **Drought:** The ongoing drought has the potential to permanently change rangeland vegetation composition to favor invasive species (including cheatgrass). Cheatgrass is prevalent in lower-elevation rangelands; however, it has increased its density in those areas and is now invading higher-elevation lands.
- **Cheatgrass invasion:** The invasion of cheatgrass has the potential to alter public land forage quality and seasonal availability. It also has the potential to increase fire frequency beyond the range of natural variation. This may, in turn, adversely impact wildlife habitat and water quality, among other resources.
- **Aquatic Invaders:** Aquatic nuisance species have been found on Navajo Lake. Active inspection programs conducted by CPW for other lakes, state-wide, has been ongoing for several years. Thus far no aquatic nuisance species have been discovered on the SJNF.
- **Riverine invasives:** An active tamarisk control program has been established on the Dolores River utilizing many partners. To date the majority of public lands along the river have been treated, an active monitoring program established, and treatment on invasive understory species such as Russian knapweed initiated. The new LRMP provides more direction to manage riverine and aquatic invaders through objectives and a standard to manage invasive species using integrated pest management principles. There are also additional guidelines addressing aquatic and riverine invasives.

3.8.3 Environmental Consequences

Direct and Indirect Impacts

Invasive species tend to prefer and spread into disturbed sites such as roads, trails, campgrounds, and overgrazed areas (Sheley and Petroff 1999). The BMP is to prevent the introduction of invasive species, but this can be unfeasible across a large landscape. Integrated management actions such as the use of an integrated chemical, mechanical, educational, and cultural management programs are the BMPs to contain invasive species once they have been introduced in an area. The LRMP is focused on this type of integrated management approach.

The increasing use of public lands for dispersed recreation uses such as hiking, biking and motorized use would likely spread invasive plant species through increased ground disturbance. Visitors from other areas are frequently the vectors for the introduction of new invasive species. Increasing oil and gas activities, through increased use of existing roads, creation of new roads, use of vehicles from other areas, and overall increased ground disturbance would also contribute to the spread of invasive species. Vegetation management projects such as fuel reduction projects also contribute to the spread of invasive species.

The alternatives that allow for the most ground-disturbing activities would provide the most opportunities for invasive species to establish and spread. Actions under Alternative A would have the greatest potential to introduce and spread invasive species. Alternative A would be followed by Alternatives D, B, and C. Mineral development ground-disturbing activities would continue even if no additional oil and gas leasing occurs. BMPs, mitigation measures, and public education and awareness programs would continue to be used in order to limit the introduction and spread of invasive species. Based on observations on the SJNF and TRFO, impacts would continue to be long term and moderate. Using early detection and rapid response strategies, most invasive species should be contained, based on successful use of these practices on the SJNF and TRFO. Sites having a potential for cheatgrass invasion would be more difficult to control because cheatgrass appears to have the ability to develop local adaptive survival strategies that allow it to successfully out-compete native vegetation. In addition, there is always the risk that a new invasive species may invade, but go undetected for some time. Should this scenario occur, then eradication of the new invader would be difficult to achieve, as a new population may have established in one or more areas. The LRMP addresses this issue through objectives, standards, and guidelines, as well as direction contained in the invasive species action plan.

Cumulative Effects

Noxious weeds and other invasive species were brought into the area from actions such as homesteading, vehicles, mineral development, timber sales, watershed improvement projects, and purposeful introductions. With the introduction of invasive species, there were adverse impacts to wildlife habitat and native species, decreased rangeland productivity, and watershed health. Invasive forage species, such as crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromus inermis*), were introduced in order to retard soil erosion and provide forage and hay for livestock. Legislative efforts to control the spread of noxious weeds began to control livestock losses from poisonous plant consumption. Budgets were limited and noxious weed control was usually funded out of the rangeland management program. Common weeds (including Canada and musk thistle, knapweeds, leafy spurge, toadflaxes, whitetop [*Lepidium draba*], cheatgrass, and tamarisk) were all introduced over the last 120 years or so.

In spite of increased acres being treated, noxious weed populations continue to increase. There are many causes (including increased wildfires, prolonged drought, increased vehicle use to access public lands, increased oil and gas activity, increased recreation activities, increased OHV use, and an increased number of visitors coming from different parts of the country) contributing to the spread of noxious weeds and other invasive species. Noxious weeds would continue to spread even if no additional oil and gas leasing occurs. While available tools such as new herbicides and new biological control agents continue to improve, the ability to successfully manage the invasive species program relies heavily on funding levels. The current noxious weed inventory for the planning area shows approximately 52,870 acres of noxious weeds infesting the SJNF and TRFO (BLM 2011a).

Invasive wildlife species include the English sparrow (Passer domesticus), European starling, and bullfrog, as well as desirable introduced species like the mountain goat, moose, and chuckar partridge (*Alectoris chukar*). Numerous exotic fish species have been introduced into the waters of the San Juan River and the upper Colorado River Basin.

The common noxious weeds and invasive wildlife and fish species described above are still impacting SJNF and TRFO lands. Other newer invasive species have been found on public lands within the last 5 years (including dyer’s woad [*Isatis tinctoria*], black henbane [*Hyoscyamus niger*], sulfur cinquefoil [*Potentilla recta*], perennial pepperweed [*Lepidium latifolium*], and dames rocket [*Hesperis*

matronalis]). Additional invasive species now found within the planning area include whirling disease and the Eurasian collared dove (*Streptopelia decaocto*). Collared doves are managed by CPW through hunting opportunities, while whirling disease management is addressed in the Aquatic Ecosystems and Fisheries section of Volume II, LRMP.

Noxious weeds would continue to spread through increased use and access to the SJNF and TRFO. Biennial thistles, such as Russian knapweed, whitetop, houndstongue, and Canada thistle, may become naturalized. New invasive species may invade local public lands. Some of these species may include camelthorn (*Acacia erioloba*), yellow starthistle (*Centaurea solstitialis*), African rue (*Peganum harmala*), orange hawkweed (*Pilosella aurantiaca*), medusahead (*Taeniatherum caput-medusae*), purple loosestrife (*Lythrum salicaria*), aquatic nuisance species, and the painted turtle (*Chrysemys picta*). Newly introduced invasive species would be the highest priority for treatment, under the new LRMP, followed by Colorado Class A and B noxious weeds, respectively. These are new management challenges and are addressed in the LRMP using an early detection rapid response strategy and prioritizing management of newly discovered invasive species in LRMP objectives, standards, and guidelines.

Whirling disease would likely spread through expanded and increased use across the planning area. It is expected that continuing public outreach and education efforts would help mitigate or slow the rate of spread over the longer term. Biological control practices should become more widely used as additional control agents are developed and tested on more target species.

Legislation may continue to be enacted in order to limit the introduction and spread of invasive species. Cooperative efforts between local, state, and federal entities would hopefully continue to be strengthened. Public awareness regarding invasive species impacts would continue to improve and increase in importance through an integrated pest management program. Again, an integrated pest management approach is a priority in the new LRMP.

Treatment costs would continue to increase; therefore, control and containment along more easily accessible areas (including roads, campgrounds, and facilities) would occur first. However, the spread of noxious weeds along trails and other less accessible areas would continue to be more expensive to control due to the need to use horses and foot traffic to access more remote areas. Overall long-term costs, however, may be reduced if biological control methods become more successful and widely used.

3.9 Timber and Other Forest Products

3.9.1 Introduction

Timber management and harvesting is an important tool for managing ecosystem diversity, forest insect and disease populations, tree growth and yields, recreation settings, wildlife habitat, and wildfire hazard mitigation. Timber harvesting provides forest products that help support local wood-processing industries and the communities associated with those industries. It helps meet the demands of the public for products such as lumber, houselogs, or other forms of roundwood. It can also influence the availability and harvesting of special forest products (SFPs), discussed below.

Multiple scales are considered in timber management on the SJNF and TRFO. The current conditions and future trends in relation to timber resources and harvesting activity on SJNF lands were evaluated at the forest and geographic area scale.

Identification of lands suitable for timber production is one of the key elements of forest plans and delineates where timber production may occur on NFS lands. Timber harvests may also occur on other lands. “Other lands” is a classification regarding lands where commercial timber production is not compatible with desired conditions and objectives, but that are physically capable and administratively available, for purposes other than the production of wood fiber (including hazardous fuels reduction, ecosystem restoration, visuals, scenic vistas habitat improvement, or other purposes).

Lands not suitable for timber harvest, due to various physical and administrative factors (including slope, soil characteristics, productivity, and/or administrative withdrawals) are also identified within the LRMP.

SFPs are products or natural resources that are not the traditional timber and fiber products, like sawtimber or houselogs. SFPs are permitted (or contracted) for removal from public lands (USFS or BLM) for commercial, personal, Native American tribal, educational, and/or scientific purposes (FSH 2409.18_80-2002). Table 3.9.4 lists common SFPs for the planning area.

Legal and Administrative Framework

Laws

- **The Organic Administration Act of 1897:** This act states that national forests are established “to improve and protect the forest within the boundaries, for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States.”
- **The Multiple-Use Sustained-Yield Act of 1960:** This act states, “It is the policy of Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes… The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple uses and sustained yield of several products and services obtained therefrom… the achievement and maintenance in perpetuity of a high level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land.”
- **The National Forest Management Act of 1976 and implementing regulations at 36 CFR:** This act sets forth the requirements for Land and Resource Management Plans for the USFS. As part of NFMA requirements tied to timber management, the act requires an assessment to determine which lands are suitable for timber production, suitable for timber harvest to meet other resource objectives, and which lands are unsuitable for such uses. It also sets forth objectives, standards, and guidelines for timber management.

Regulations and Policies

The following USFS manuals and handbooks provide regulation and policy direction for timber management, associated resource issues, and the offer and sale of traditional and SFPs.

- 2400 - Timber Management – Forest Service Manual for Timber Management
- 2409.11 - National Forest Log Scaling Handbook
- 2409.11a - National Forest Cubic Scaling Handbook
- 2409.12 - Timber Cruising Handbook

- 2409.12a - Timber Volume Estimator Handbook
- 2409.12b - Timber and Forest Products Trespass/Theft Procedures Handbook
- 2409.13 - Timber Resource Planning Handbook
- 2409.13a - Timber Permanent Plot Handbook
- 2409.14 - Timber Management Information System Handbook
- 2409.15 - Timber Sale Administration Handbook
- 2409.17 - Silvicultural Practices Handbook
- 2409.18 - Timber Sale Preparation Handbook
- 2409.19 - Renewable Resources Handbook
- 2409.21e - Timber Management control Handbook
- 2409.21h - Timber Management Data Handbook
- 2409.22 - Timber Appraisal Handbook
- 2409.26 - Silvicultural Practices Handbook
- 2409.26b - Reforestation Handbook
- 2409.26c - Timber stand Improvement Handbook
- 2409.26d - Silvicultural Examination and Prescription Handbook
- 2409.26e - Nursery Handbook
- 2409.26f - Seed Handbook
- 2409.26g - Tree Improvement Handbook

All forest products—traditional, such as sawtimber, and SFP, such as Christmas trees, transplants, or medicinal plants—must be sold and harvested in a manner that maintains the products on a sustainable basis.

3.9.2 Affected Environment

Existing Conditions and Trends

Past timber harvesting and fire suppression are two key activities that have influenced current vegetation conditions and must be considered in planning for the future. Areas that have been treated (primarily, thinned or harvested) more recently may not be available for subsequent harvest activities during the planning period (approximately 15 years) covered by the new LRMP.

The majority of forest vegetation types are in the mature stage (due to lack of disturbance, such as fire or harvesting), with dense stand conditions, including spruce-fir, mixed conifer (both warm-dry and cool-moist), and ponderosa pine types (see Section 3.2, Terrestrial Ecosystems and Plant Species). These stand conditions are vulnerable and have been recently subjected to significant levels of insect and/or disease attack. Epidemic-level mortality has occurred, or is ongoing, in all but the ponderosa pine vegetation type and has occurred in aspen and aspen with conifer forest types, as well (and the pinyon-juniper woodland type). Timber management activities may be used to alter stand conditions in order to reduce ongoing insect and disease activity, as well as the risk for future outbreaks. Timber management is generally not effective in stopping or inhibiting ongoing insect

epidemics, since outbreaks generally overwhelm such efforts. Timber management trends in recent years, and integral to the focus of the revised LRMP, has been to restore timber stands to conditions more resilient to insect outbreaks, widespread disease, or unnatural wildfire.

Long-term drought conditions have been a key driver in the abovementioned insect- and disease-related mortality and have increased concern regarding declining forest health in all forest vegetation types. Silvicultural prescriptions have been designed in recent years to favor drought-resistant species (like ponderosa pine) while focusing removal of drought-susceptible species (like white fir). Additionally, thinning objectives, particularly in lower-elevation (hence, warmer/drier) forests, like ponderosa pine and warm-dry mixed conifer, have been to substantially reduce tree densities to better allocate residual timber to less available soil moisture.

Relatively recent wildfires, including the Missionary Ridge Wildfire of 2002, as well as high mortality from insects and disease, have resulted in substantive vegetative changes (including impacts to many acres of suitable timberlands). The resulting changes in age class and stocking may reduce the yield of timber products in the future.

Within the planning area, the timber management program is dependent on the Colorado timber industry. Both timber demand and timber industry capacity have decreased, particularly demand for conifer-based products. Recovery of the timber industry is expected to be slow. Further reductions in the industry may severely restrict timber management as a tool used to accomplish desired changes in vegetation conditions (e.g., reduction of insect and disease risk, or reduction of hazardous fuels), and meet public demands for building materials and other wood products. Costs to accomplish vegetation treatments without commercial harvests are generally much higher and may prove to be prohibitive under constrained budgets expected with the new LRMP. For instance, from 2002 to 2007, the SJNF paid an average cost of $644 per acre for timber removal on the Columbine Ranger District on projects to reduce fuels near private lands (Crawford 2008). In past decades, the same work might have been accomplished by timber sale purchasers paying the SJNF to cut and remove these trees.

The aspen-product industry has remained relatively stable. Aspen has been managed throughout the planning area for more than six decades. Many of the stands treated in the 1940s and 1950s are approaching maturity. A challenge of the new LRMP will be to ensure a sustainable supply of aspen to industry as the SJNF transitions into re-entering these maturing stands for harvest.

Recently, other forms of industry have emerged that use timber products in unconventional, or expanded, ways. For instance, a local business in Pagosa Springs was recently awarded a long-term (10-year) stewardship contract intended to expand use of material from cut (harvested) trees. The contractor would construct a gasification plant that would convert the cut-tree material (biomass) into electricity. Additionally, investigations into wood-pellet manufacturing plants have occurred in southwest Colorado. Efforts such as these may add to additional ways in which forest vegetation treatment objectives can be met.

Timber Management Goals

The general goals for timber management on NFS lands include:

- providing for timber production;
- sustaining healthy forest conditions; and
- creating forest conditions that benefit, or are conducive to, management of other resource values (including wildlife habitat, recreation, aesthetics, or livestock grazing).

There are several components of timber management that the USFS considers in its planning process and are addressed in the new LRMP. They include the determination of the:

- capability, availability, and suitability of NFS lands for timber production;
- type of silvicultural systems that are to be used in timber management; and
- amount of timber that can be harvested in a sustainable manner.

In addition to determining the amount of timber that can be potentially harvested sustainably, the LRMP sets, as an objective, two timber program quantities based on land management goals and expected harvest and funding levels:

- **Allowable sale quantity (ASQ):** the quantity of timber that may be sold from the area of suitable (for production) land covered by the LRMP; this is also referred to as “chargeable volume;” this is displayed in these LRMP revision documents as an upper threshold, under what might be viewed as a “full” budget, that is, fully meeting timber management goals;
- **Timber sale program quantity (TSPQ):** the volume of timber planned for sale during the first decade of the planning horizon given expected funding levels; it includes volume from suitable for production lands (i.e., ASQ or chargeable volume and additional material [non-chargeable volume], such as fuelwood or products derived from other lands suitable for harvest to meet objectives other than timber production).

Both TSPQ and ASQ are expressed as an annual average.

Several determinations related to timber management must be made as part of forest planning, and these determinations are reviewed each time the LRMP is revised or when conditions change. Areas that are, and are not, suitable for timber harvest—and further delineated into areas suitable for timber production—are identified, taking into account physical, biological, and economic factors. Where timber management is determined to be a suitable use, it must occur at sustainable levels.

Timber suitability is determined through a process established through the NFMA and planning regulations. This winnowing process first identifies lands not suitable for harvest by excluding areas where a) site conditions preclude tree cover, b) harvest is prohibited by statute or regulation (e.g., wilderness), c) irreversible resource damage could occur from timber harvest (e.g., steep or unstable slopes), and d) adequate restocking, with trees, following harvest is not assured. Lands remaining after this exclusionary process are deemed “lands generally suitable for harvest.” These remaining lands are broken into two classes: a) lands suitable for timber production (“suitable timberlands”) and b) other lands where harvest for multiple-use objectives other than timber production may take place.

Capability to Produce Timber

Within the planning area, determining which areas are capable of producing commercial timber is done by evaluating physical and biological characteristics, as well as any administrative limitations, of an area. The total area capable to produce timber is 917,240 acres.

Suitability to Produce Timber

Suitability determinations are a further refinement of forested lands found to be capable of producing commercial timber. These determinations are based primarily on social and economic considerations. This process was used to determine suitable timberlands for the 1992 amendment to the San Juan

National Forest Land and Resource Management Plan (USFS 1983). Table 3.9.1 lists the existing suitable timberlands within the planning area.

Table 3.9.1: Current Acres of Suitable Timberlands in the 1992 Amendment to the San Juan National Forest Land and Resource Management Plan and the 1985 San Juan/San Miguel Resource Management Plan

Category	Acres	Percentage of SJNF and TRFO
USFS suitable timberlands	375,000	20%
Suitable conifer timberlands	285,784	15%
Suitable aspen timberlands	89,216	5%
BLM suitable conifer timberlands	10,960	>1%

Allowable Sale Quantity

Under the 1982 Forest Planning Rule 3, the USFS was required to determine ASQ in forest planning. This annual harvesting level must be sustainable over the long term. Table 3.9.2 shows the annual ASQ determined for the SJNF in both the 1983 San Juan National Forest Land and Resource Management Plan and the 1992 amendment to that plan. The 1992 amendment estimated that 25%, or 6 million board feet (MMBF) of the ASQ, would be aspen. (ASQ has been calculated for the revised LRMP as well.)

Table 3.9.2: San Juan National Forest and Tres Rios Field Office Annual Allowable Sale Quantity

Plan	Total Volume MMBF*
1983 San Juan National Forest Land and Resource Management Plan	41
1992 Amended San Juan National Forest Land and Resource Management Plan	24
BLM	0.65
* Volume in MMBF	

Timber Harvest Activity

Timber harvesting activities began in the San Juan Basin in the early 1880s, approximately 20 years before the SJNF was established (1905). The ponderosa pine forest type was most impacted by these early multiple-entry logging activities. This initial “harvesting” was, essentially, cutting and removal of mature overstories with, likely, no intent or little effort to re-establish young forests on these cutover areas. It was not until later—part of the impetus to create the NFS—that the need was seen to foster regeneration. Since the creation of the SJNF, harvesting activities have occurred in all commercial forest types.

Between 1955 and 2004, approximately 230,117 acres were harvested, along with another 133,246 acres of TSI. (TSI is an intermediate treatment designed to improve the composition, structure, condition, health, and growth of even- or uneven-aged stands. This treatment may include thinning, release, cleaning, weeding, or liberation. TSI activities are not intended to establish regeneration.) This equals 19% of the total SJNF land area (12%, if TSI acres are excluded). Harvested acres have remained relatively low on SJNF lands since 2004, mostly occurring in aspen and ponderosa pine on the Dolores Ranger District. This downward shift in harvesting was largely due to the need for urgent removal of dead and dying timber—mostly, lodgepole pine—elsewhere in Colorado by timber

purchasers holding timber sale contracts on the SJNF and other Rocky Mountain region forests. Harvesting figures were not available for the BLM, but are assumed to be near zero.

The even-aged silviculture system of shelterwood harvests has been the most common prescription within the planning area in the past and prescribed primarily in the spruce-fir and ponderosa pine vegetation types. Even-aged silviculture was common in the past, but is seldom used today (with the exception of application to aspen, which is nearly always clear felled and regenerated by root suckering—"coppice") (Figure 3.9.1). Uneven-aged silviculture systems (including group selection and single-tree selection) are well suited to the spruce-fir and ponderosa pine forests found in the San Juan Basin and are the most commonly used management methods today in coniferous forests. These silvicultural systems—coppice in aspen forests and group selection in coniferous forests—would continue to be prescribed in the next 15 years of the revised LRMP. Additional silvicultural methods would be authorized as well.

Timber harvesting or thinning on BLM lands was primarily in the ponderosa pine type, or in the spruce-fir type in the Silverton area, and was seldom commercial in nature. Generally, trees were selected for removal on BLM lands based on their suitability for mining, construction, and/or personal use for construction of homes and ranch buildings. There are no harvesting objectives for timber production on BLM lands in this LRMP.

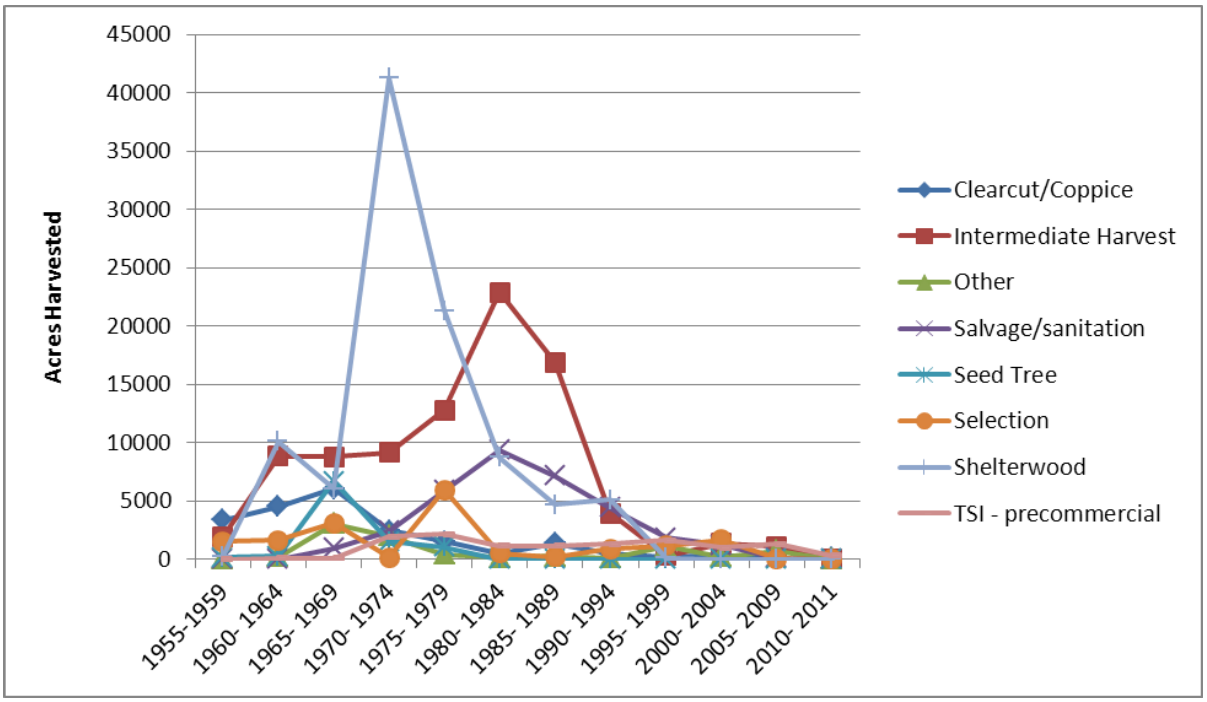


Figure 3.9.1: Acres Harvested by Silvicultural Methods on the San Juan National Forest, 1955 through 2004

TSI in the planning area peaked in the 1980s and continues today. TSI on the SJNF is primarily used for fuels reduction and restoration treatments in ponderosa pine and warm-dry mixed conifer vegetation types. TSI is often broken down into two categories, pre-commercial and commercial. Pre-commercial TSI concentrates thinning in sapling- or pole-sized trees that have little commercial value. Commercial TSI, also referred to as "improvement" cutting, concentrates thinning in sawtimber-sized

trees. In most cases, these are “thinnings from below”—that is, the bulk of the trees cut and removed are the smaller trees in the stand, favoring larger trees for retention.

Sanitation and salvage cutting on the SJNF has occurred in ponderosa pine, mixed conifer, and spruce-fir types. In ponderosa pine forests, these methods have been used in order to treat dwarf mistletoe (*Arceuthobium* sp.) infestations and recover dead trees for commercial use. Sanitation and salvage in spruce-fir forests was most prevalent in the late 1970s (to treat spruce beetle mortality). These treatments continue today, but generally on a smaller scale, with the goal of recovering pockets of sound mortality and reducing the spread of insects and disease.

During the 1960s and 1970s, clearcutting was used to harvest spruce-fir forests within the planning area. This harvesting method was discontinued in spruce-fir in the late 1970s. Coppice (or “clear felling”—like clearcutting but dependent on sprouting from roots rather than from seed or plantings) is considered the optimum silvicultural treatment in aspen forests. Most of this activity has occurred since the mid-1940s, when aspen harvesting for the Mancos matchstick plant (currently Western Excelsior) began.

Outside harvesting of aspen by coppice, the majority of timber cutting and removal on the SJNF since around 2000 has been improvement cutting in ponderosa pine and warm-dry mixed conifer stands to meet forest restoration objectives, most of this falling in the WUI.

The current spruce beetle epidemic, initially spreading from the neighboring Rio Grande National Forest onto the SJNF north of Wolf Creek Pass and largely confined to the Weminuche wilderness, has expanded greatly to the west (crossing the Upper Pinos River on the Columbine Ranger District) and is moving south from Wolf Creek Pass. This outbreak has killed an estimated 80% to 90% of overstory Engelmann spruce in the Wolf Creek Pass area (and the eastern two-thirds of the Weminuche wilderness). It has been expanding onto current suitable timberlands north and northwest of Pagosa Springs, including shifting down in elevation into mixed conifer stands where blue spruce is succumbing to attacks. The cumulative acres affected on the SJNF are estimated at 130,000 (Rocky Mountain Region 2012). There are no indications that this outbreak is abating or how much overstory spruce would remain once the outbreak has subsided. This could have long-term impacts on suitable timberlands that have a significant spruce component. The potential exists now and into the future for salvage of large volumes of standing dead spruce.

Timber harvesting (coupled with regeneration) and thinning, including sanitation and salvage, would continue to be applied to meet management objectives associated with the revised LRMP. Objectives would include timber activities in coniferous and aspen forest vegetative types.

Regeneration Success

Within the planning area, timber regeneration needs have resulted from timber harvests, wildfires, and insect- or disease-caused mortality. Regeneration can occur through natural reseeding and/or suckering (as in aspen), or from artificial methods such as hand seeding and/or planting. (Note that artificial seeding of trees—by hand or machine—is rarely used due to poor success rates.)

On suitable timberlands, areas must be adequately stocked (i.e., have a minimum number of live trees per acre) within 5 years following a final regeneration harvest. Final regeneration harvests include clearcuts/coppice, shelterwood removal cut, seed tree removal cut, or a selection harvest. If natural regeneration is inadequate, it may be supplemented with hand seeding and/or with planting. Regeneration survival surveys are normally conducted 1, 3, and 5 years after treatment.

Regeneration standards (the required number of live seedlings/saplings per acre) vary by species and site productivity.

Past regeneration failures were most common in higher-elevation spruce-fir harvests that occurred in the 1960s, which primarily used the clearcutting harvest method. Many of the initial planting efforts failed because there was no protection for planted seedlings on these sites. (Engelmann spruce is best adapted to growing in shaded conditions.) Due to poor reforestation success, this method is no longer used on spruce-fir sites. Table 3.9.3 summarizes regeneration success for tree species in the planning area, from 1983 to 2004. (Note that lodgepole pine was first introduced to the SJNF when efforts were made to reforest the Lime Creek Burn area near Molas Pass. It has been used elsewhere on the SJNF as well, mostly following harvesting in spruce-fir stands. These plantings fall outside the natural, adapted range of lodgepole pine. Some efforts are ongoing on the SJNF to replace this off-site species with naturally occurring species.)

Table 3.9.3: Regeneration Success by Tree Species, 1983 to 2004

Tree Species	Natural Regeneration Certified as Stocked	Planting Success	Seeding Success	Regeneration Surveys in Progress
White fir	100%	–	–	0%
Subalpine fir	82%	18%	–	0%
Aspen	98%	–	–	2%
Lodgepole pine	8%	92%	–	0%
Engelmann spruce	25%	72%	–	3%
Ponderosa pine	24%	73%	–	3%
Douglas-fir	9%	91%	–	0%
Unknown	28%	12%	–	60%

Note: Plantings have occurred since 2004, mostly since 2009. 1st-, 3rd-, and 5th-year surveys continue. Ponderosa pine planting success has ranged from 40% to 70%; Engelmann spruce success from 45% to 65%. Recent drought and significant weather events have adversely impacted planting efforts.

Natural regeneration has been very successful on aspen and true-fir sites (approximately 90%–100%), as well as on all vegetation types where selection harvesting methods have been used. Planting has been required on many spruce-fir and ponderosa pine sites where even-aged silviculture has been used and has been successful about 75% of the time.

Control of conditions for cleaning and storing seed, and for growing and associated treatment of trees in nurseries, has improved over time. Similarly, monitoring of planting sites and weather conditions has slightly improved as well. Hence, planting success is expected to at least meet, if not slightly improve upon, success levels of the past.

Volumes Harvested

A timber sale sold during 1 year may have volume harvested over several years. The USFS tracks harvested timber volumes by species and type of product or component. (Sawtimber is a log reaching a size that can be cut into commercial-grade boards, generally 8 inches or larger in diameter. Products other than logs include posts and poles with diameters usually less than 8 inches, as well as all aspen products. Utilization standards for these products can be found in Volume II, LRMP, under Timber and Other Forest Products). Figure 3.9.2 displays the volume of timber sold and harvested from the planning area between 1983 and 2011.

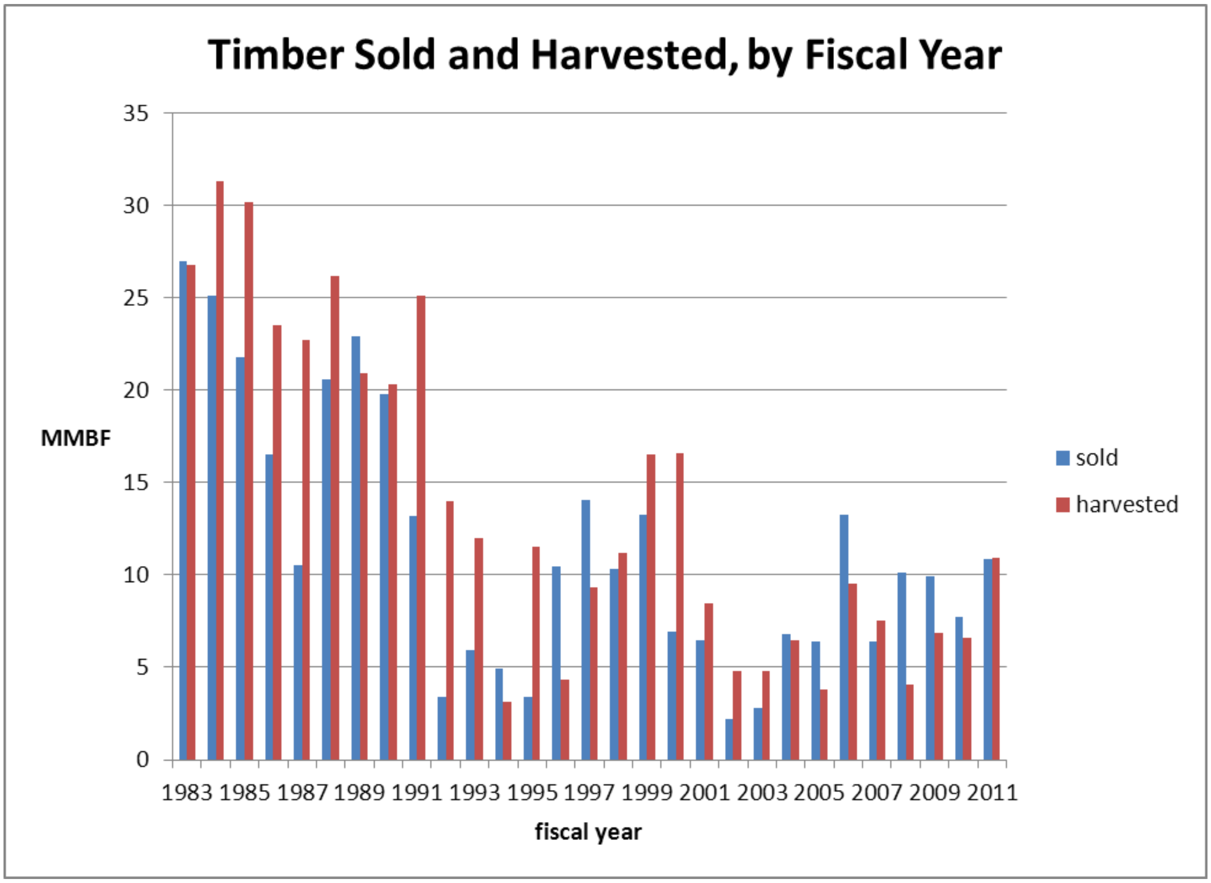


Figure 3.9.2: Volume of Timber Sold and Harvested on the San Juan National Forest (1983–2011)

SFPs permitted for harvest and removal from the planning area are categorized into two types:

- **Convertible products:** Convertible SFPs are products from timber that can be measured in cubic or board feet.
- **Non-convertible products:** Non-convertible SFPs are products that cannot be measured in cubic or board feet.

Currently, commercial uses of SFPs are regulated by permit or contract. Personal use permits generally require a minimum $20.00 fee, except for Christmas trees. Christmas trees are sold for $8.00 a tree.

A list of SFPs and their typical uses is displayed in Table 3.9.4.

Table 3.9.4: Special Forest Products in the San Juan National Forest and Tres Rios Field Office

SFP	Most Common Species	Personal Use	Commercial Use	Educational/ Research Use
Firewood	Dead, live conifer, Gambel oak, aspen	x	x	
Christmas trees	White fir, pinyon	x	x	
Transplants	White fir, aspen, shrubs	x	x	
Tipi poles	White fir, spruce, Douglas-fir	x	x	x
Corral poles	Aspen, ponderosa pine	x	x	

SFP	Most Common Species	Personal Use	Commercial Use	Educational/ Research Use
Walking sticks	Aspen	x		
Medicinal plants	Osha, arnica, Oregon grape root	x	x	x
Herbarium specimens	Common vascular plants			x
Native seeds	Grasses, wildflowers, shrubs	x	x	x
Dry cones	Ponderosa pine	x		
Boughs	Douglas-fir, white fir	x	x	
Green cones for seed	White fir, blue spruce, ponderosa pine, subalpine fir		x	
Mushrooms	Boletes, chanterelles, morels, puffballs	x	x	x
Bark chips	Pine, juniper	x		
Fence posts	Utah and Rocky Mountain juniper	x	x	
Burls and decorative wood	Aspen, juniper	x	x	
Berries	Chokecherry, serviceberry, raspberry	x	x	
Nuts	Pinyon	x	x	
Fence stays	Aspen, Gambel oak	x	x	
Tree buds	Spruce	x	x	
Latillas	Aspen	x	x	

Convertible Products

Personal use of convertible products requires a “free use” or “personal use” permit. Typical convertible SFPs permitted on the SJNF and TRFO are fuelwood or posts and poles.

One of the goals of the current LRMP is to provide a supply of fuelwood to local residents. Fuelwood harvesting is accomplished both through commercial and personal use permits. In years past, mostly dead timber was harvested, along with limited amounts of green wood provided in specified areas. More recently, thinning in lower-elevation stands, particularly in ponderosa pine, by SJNF and TRFO crews or by contractors, has made available increased amounts of (relatively) green wood. This work has effectively met ecological and social/economic objectives—that is, fuels reduction/forest restoration and demand for fuelwood. These efforts would continue in the future with the revised LRMP.

Fuelwood areas vary by year. Where specific units have been set aside for cutting for public fuelwood, affected acres have been tracked. Elsewhere, dispersed collection of fuelwood is generally not tracked. The volume of fuelwood harvested is monitored based on the number of permits sold. Figure 3.9.3 displays the trend in fuelwood harvesting from 1983 through 2011.

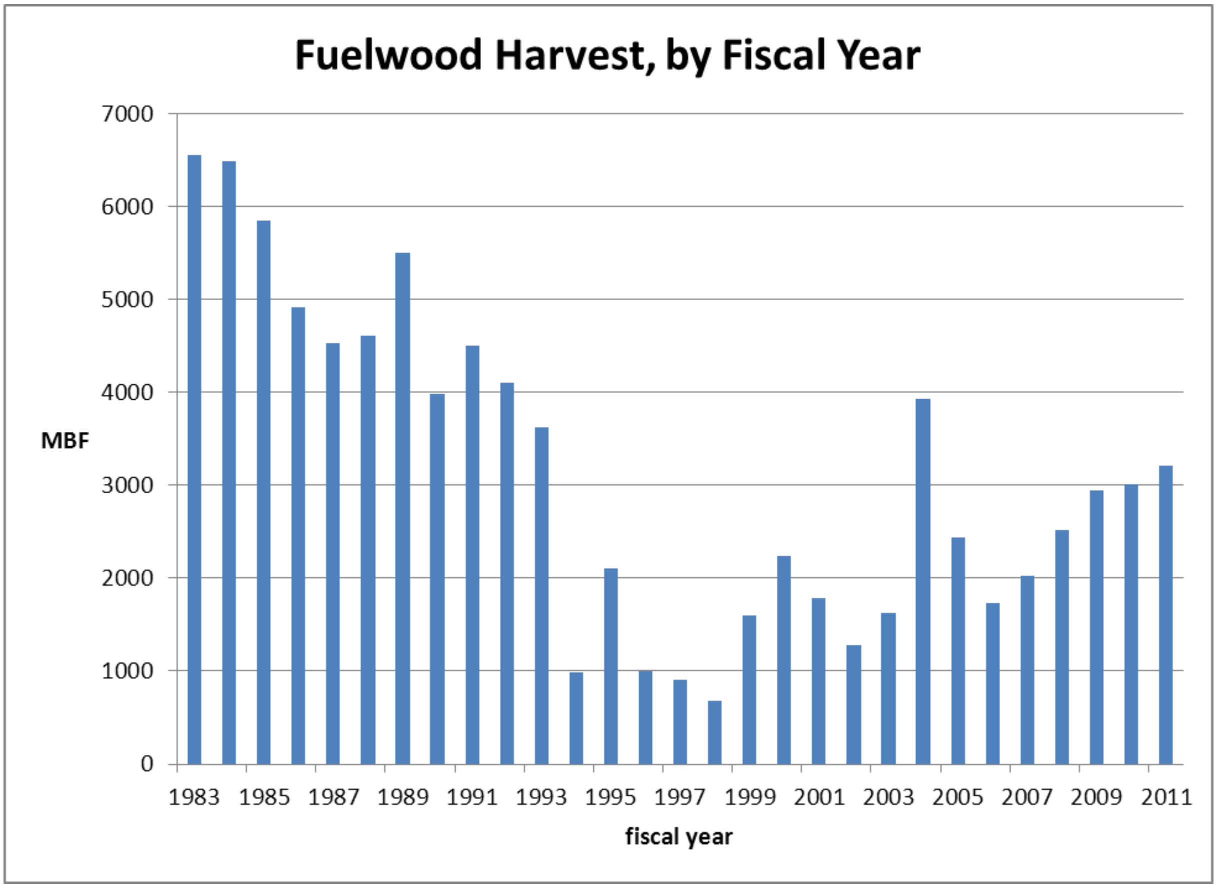


Figure 3.9.3: Fuelwood Harvest on the San Juan National Forest (1983–2011)

All convertible products are and would continue to be monitored and inventoried through the timber and fuels programs (with stand exam and cruise information developed in order to monitor tree density and product size).

Non-convertible Products

Non-convertible products are usually not collected for large commercial purposes. Non-convertible products for personal use that require a free use or a personal use permit (also requiring a minimum $20.00 fee) include Christmas trees, transplants, seeds, or cones. Some non-convertible products collected for personal use in small quantities do not require a permit. Products collected for educational purposes require an administrative or free use permit.

Harvesting of mushrooms involves removal of just the aboveground fruiting body. This harvesting has not been an issue within the planning area.

Collection of seed heads, cones, berries, leaves, or boughs has not been known to limit the populations of the plants or trees, unless ethical harvesting guidelines are not followed. Currently, all permits and contracts require that portions of all populations or seed caches remain undisturbed in order to ensure sustainability. Harvesting practices that remove whole plants (including roots) have the greatest potential for adverse impacts.

Osha (*Ligusticum porteri*) is a higher-elevation plant collected for medicinal purposes. The entire plant is dug up, and the roots are then used in the preparation of medicines. This plant is traditionally used

by Native Americans, as well as by local Hispanics. Some pharmaceutical companies (local and foreign) and local herbal remedy businesses sell Osha. Osha is extremely difficult to cultivate and is almost always harvested in the wild.

United Plant Savers has listed Osha as a species of concern. It has become locally extinct in some of its former range. Due to the lack of information regarding the biology of this plant, and the concerns over what is a sustainable harvest, the Denver Botanical Gardens and the Medicinal Plant Working Group have begun monitoring Osha on some plots within the Rio Grande National Forest. In conjunction with this project, some plots within the planning area have been established in order to verify the results from the Rio Grande study and develop guidelines for the sustainable harvesting of Osha.

Summary of Existing Conditions and Trends

Currently, approximately 49% of the NFS lands within the planning area are capable of growing commercial timber. Under the 1992 amendment to the San Juan National Forest Land and Resource Management Plan, 20% of NFS lands within the planning area is identified as suitable timberland.

Over the period 1955 to present, approximately 19% of the planning area has had timber harvesting activities. This equals less than 30% of the forested cover within the planning area.

The most common harvesting methods have been shelterwood (mostly in spruce-fir and ponderosa pine), followed by clearcut in spruce-fir (mostly in the 1960s and 1970s) and in aspen (coppice), then by TSI and sanitation/salvage. The most common treatments currently are selection and intermediate treatments (improvement thinning) for fuels reduction or forest restoration purposes.

The ASQ for the SJNF was never fully offered, and sold or harvested, during any year between 1983 and 2011.

The ongoing spruce beetle epidemic is affecting much of the spruce component (Engelmann spruce in spruce-fir stands, blue spruce in mixed conifer stands) in the eastern half of the SJNF, including spruce found on suitable timberlands. The potential exists now and into the future for salvage sales of large volumes of standing dead spruce.

Historic regeneration failures are mostly attributed to higher-elevation spruce-fir harvests that occurred in the 1960s and 1970s, where clearcutting was the predominant silvicultural method in use at that time.

Natural regeneration has been very successful on aspen and true-fir sites (approximately 90%–100%), as well as all vegetation types where selection harvesting methods have been used. Planting has been required on many spruce-fir and ponderosa pine sites where even-aged silviculture has been used and has been successful about 75% of the time.

The trend in total acres harvested shows a sustained high level for three 5-year periods, beginning in the mid-1960s through the 1970s, and declining since that time. The trend in volume offered and sold since 1983 reflects relatively high levels in the 1980s (excepting 1987), a moderate sustained level in 1996–1999, with a return to a somewhat lower sustained level since 2008. The trend in total volume harvested since 1983 reflects a peak in the mid-1980s and a much lower peak in 1999–2000. Annual harvesting activities show less fluctuation between years than do sale offerings.

Most fuelwood harvested in the planning area is through personal use permits.

Trends in fuelwood harvest show a peak in 1983. Demand, and harvest, leveled out in the 1990s but has increased in recent years.

3.9.3 Environmental Consequences

Direct and Indirect Impacts

General Impacts Related to Timber Management

- **Volume Harvested:** Estimated volumes planned for harvest (TSPQ/ASQ), by alternative, are displayed in Chapter 2 of this LRMP/FEIS.
- **Road Construction/Reconstruction:** Estimated miles of road construction and miles of reconstruction of existing roads varies by alternative (Table 3.9.5).

Table 3.9.5: Estimated Miles of Road Construction and Reconstruction by Alternative

Activity	Alternative A	Alternative B	Alternative C	Alternative D
Road construction	3.0	0.5	0	3.0
Road reconstruction	7.2	7.6	5.6	8.2

- **Reforestation Success:** Past reforestation success levels displayed above in the Section 3.2.2 is expected to continue at similar, or slightly improved, levels in the future.

Impacts Related to Suitability

Lands identified as generally suitable for timber harvest (selected from lands that area physically capable and administratively available) vary by alternative (Volume III, Appendix V, Maps 12–15). These lands include both lands where timber production is compatible with desired conditions and objectives, as well as lands where timber harvesting may occur (but where timber production is incompatible with desired conditions and objectives). The ratio of timber harvesting from these two categories of lands varies by alternative.

Within the planning area, the majority of timber harvesting would be used in order to meet desired vegetative conditions (including improvements in age-class distribution, reduction of hazardous fuels, and improvements in stand structure or composition designed to return forest vegetation to desired conditions). Forests may be actively managed in order to reduce the intensity and extent of disturbances (e.g., wildfire or insect epidemics) that otherwise might result in damage to ecosystem processes and functions. Management activities may also be used to maintain forested vegetation at a desired point within the HRV in order to avoid broad swings in various elements that have occurred naturally over time, but are undesired today. (An example would be a vegetation type that ranged from nearly all early seral stands over the planning area to nearly all mature stands.) To avoid high-severity events that might facilitate these swings (large-scale wildfire or insect epidemic), it is more desirable to maintain a good mix of age classes near the center of the HRV, thereby meeting desired conditions for maintaining or improving ecosystem function, resilience, and sustainability.

The current and expanding spruce beetle epidemic, now having spanned the approximate eastern half of SJNF high-elevation spruce-fir in the San Juan Mountains (and also expanding in the South San Juan Mountains), is causing widespread mortality in the spruce component. Given that many of the spruce-fir stands with greatest mortality (or risk of mortality) from spruce beetle attack have relatively sparse understories, and Engelmann spruce or subalpine fir are relatively slow growing in

the young development stages (i.e., as seedlings and saplings,), the combination of both would delay the re-establishment of growing stock in spruce-fir suitable timberlands that have undergone extensive spruce beetle associated mortality. Hence, timber production from spruce-fir suitable timberlands, and the associated ASQ, for the period of this new LRMP may be reduced under all alternatives. Total harvest quantities, on the other hand, may not be reduced given that salvage of standing dead spruce serves as a substitute for volume that would have derived from suitable timberlands.

The alternatives vary in areas where timber management may occur in order to achieve the desired vegetative conditions and objectives for timber program offerings. Alternative A would have the most acres available for management and highest harvesting objective in terms of number of acres, with Alternatives D, B, and C following in descending order, respectively. Alternative D would result in the greatest opportunity to provide vegetative conditions that limit the intensity and extent of disturbances (including from wildfire and insect epidemic), whereas Alternative C would provide the least opportunity.

Impacts Related to Insect and Disease Management

Insects and disease would impact the production of timber by killing and damaging trees. Tree damage or mortality could occur on a variety of scales, depending largely upon factors such as insect populations or disease extent, stand conditions, and natural events (including wind and climate). At epidemic levels, insects and diseases do not respect administrative boundaries; therefore, there would be an increased risk of damage and mortality to adjacent lands actively managed (as opposed to areas where natural processes dominate). Although salvage operations are allowed in some MAs, or portions thereof (MAs 3*, 4, 5, 7, 8, and some 2s), it would be done to meet the resource objectives of those MAs and may not be considered a reliable source of additional wood fiber. (*See exception discussed below for MA 3 lands under Alternative C.)

In relation to insects and disease, Alternative C may represent the greatest potential impact to timber, followed by Alternatives B, A, and D, respectively. Potential impacts are a result of the emphasis each alternative places on preserving the undeveloped character of areas and allowing natural processes to occur. As has been seen in recent years, elevated levels of insects and disease, in particular, bark beetles, can and have built up in roadless or wilderness (or other untreated areas) and then impacted nearby or adjacent suitable timberlands. Under Alternative C, timber harvest to meet other resource management objectives would not be allowed in nearly all MA 3 lands since the bulk of these lands would meet the available and capable requirements for wilderness protection.

Impacts Related to Fuels Treatments

Fuels treatments (prescribed burns and mechanical means, including mastication or thinning) have similar impacts related to thinning (as described below). Advanced regeneration may be lost, which may delay future harvests, especially where regeneration must be re-established prior to harvesting or where stocking is insufficient to take advantage of growing conditions. Fuels treatments improve individual tree growth and vigor due to the reduction of competition for moisture and nutrients related to the impacts of thinning. The long-term impacts of fuels treatments on timber outputs and forest health are generally positive, decreasing the potential loss of growing stock due to crown fire, insect epidemics, disease, drought, or any combination of these factors.

Given the assumption that fuels treatments are done in a manner that falls within implementation constraints—in particular, prescribed burning, which carries some uncertainty—Alternative D would result in the greatest benefits from fuels treatments given the estimated acres to be treated for fuels

reduction benefit. The benefits of Alternatives B and C would be similar; the benefit of Alternative A would be least.

Impacts Related to Wildfire for Resource Benefit

The impacts related to wildfire for resource benefit within suitable timberlands are similar to the impacts described above for fuel treatments, in general. There is the potential for loss of growing stock and large investments in regenerated stands over wide areas if wildfire for resource benefit is not carefully applied or if unexpected weather conditions develop that compromises initial expected benefits. In general, the improvements in growing conditions and overall forest health outweigh the risk of loss. Resource benefit wildfire planning and administration need to be carefully considered in view of at-risk timber resources. Proposed levels of wildfire for resource benefit would be similar under all of the alternatives; therefore, there would be similar impacts.

Impacts Related to Oil and Gas Development

Roads, well pads, and ancillary facilities associated with oil and gas development take forested land out of production (reducing future outputs); however, the acreage involved would be minor in comparison to overall suitable timberlands. Small short-term increases in timber outputs may occur during field development as timber is harvested (due to clearing for road and well-pad construction). These outputs are accounted for in the category of “other lands,” where timber production is incompatible with desired conditions and objectives.

Impacts would be similar for Alternatives A, B, and D, about 1% or less of long-term timber production loss (though with short-term increases in small sales), and least for Alternative C. Under the No Leasing Alternative, lands affected and taken out of timber production would be those on existing leases only.

Impacts Related to Recreation

Generally, impacts to the timber program related to recreation would be small. Small short-term outputs may occur from ski area, or other recreation facility, development. These outputs are accounted for in “other lands” estimates. Commercial timber or fuelwood may also be harvested when removing hazard trees from recreation facilities. User conflicts between recreationists and timber purchasers are becoming more common, particularly concerning road use. These conflicts can result in increased restrictions on timber purchaser operations, leading to increased costs and reduced financial efficiency.

The impacts on timber production from recreation would be similar under Alternatives A, B, and D, and slightly reduced under Alternative C, and would be minor.

Impacts Related to Harvesting and Removal of Convertible Special Forest Products

The impacts related to personal use convertible products are negligible and are dispersed over a wide area. Generally, the collection of convertible products would benefit the public. It may also help to reduce, incrementally, stand density and hazardous fuels within the planning area, and concentrating fuelwood gathering in strategically located stands can be effective in reducing fuels in or near the WUI. Most of the collection of convertible forest products would continue to occur near the road system that is open to the public. Alternatives that limit new road construction (e.g., no new oil and gas leases) would reduce the effects since new access to SFPs would be more limited.

Within the planning area, convertible products would be monitored and inventoried through the timber and fuels programs, via stand exam or cruise data collection.

The environmental impacts are similar under all of the alternatives. Alternative D would result in the greatest impact; Alternative C would result in the least impact. Even between these two alternatives, however, the differences are negligible, with the primary difference linked to the potential area accessed by open roads.

Impacts Related to Harvesting and Removal of Non-convertible Special Forest Products

Little impact is expected from the minor amounts of harvesting or collecting that occurs.

Harvesting of the fruiting bodies of mushrooms would not impact the mycelium that occurs underground, unless compaction or ground disturbance occurs as part of the harvesting process.

Collection of seed heads, cones, berries, leaves, or boughs would not limit the populations of the plants or trees, unless ethical harvesting guidelines are not followed. All permits and contracts would continue to require that portions of all populations or seed caches remain undisturbed in order to ensure sustainability. Harvesting practices that remove whole plants (including roots) would result in the greatest potential for impacts; Osha harvesting remains a concern. Alternatives that include no new oil and gas leases would further reduce the effects since new road construction and the access to SFPs would be the most limited.

The collection of non-convertible forest products may continue to be very limited in distribution and in quantity. Currently, there is no threat to any of the species collected at this level of collection; however, as human population increases and demand climbs, threats to local populations may become more evident. Additional information would be needed in order to determine the factors that need to be considered in monitoring use.

The environmental impacts are expected to be similar under all of the alternatives. Alternative D may result in the greatest potential impacts. Alternative C may result in the least potential impacts.

Currently (as under Alternative A), the sustainable harvesting of Osha is occurring within the planning area. However, future demands may exceed supply outside wilderness areas and IRAs. There would be no difference between the alternatives concerning Osha harvesting, given that agency direction to permittees continues to emphasize ethical harvesting techniques. Sustainable levels are expected to be maintained under all of the alternatives.

Cumulative Impacts

The affected environment portion of this section describes historic, current, and foreseeable future activities considered with regard to cumulative impacts to the forest resource. The next 15 years are used as the timeframe for cumulative impacts analysis.

Given the overall size of the planning area and the relatively small amounts of treatment proposed under all of the alternatives, timber harvesting from suitable timberlands would result in a small change in the age/size-class distribution of forested lands. The major agents of change to forested lands would continue to be tree establishment/growth/maturation/senescence, vegetative competition, endemic insects or diseases, and disturbance events, including wildfire, weather (wind, heavy snow/ice and potential avalanche cycles), or insect or disease outbreaks. Climate change is predicted to exacerbate some of the above impacts, including increased tree mortality from 1) increasing

populations of bark beetles; 2) heightened competition between vegetative components as a result of higher average temperatures and increasing drought effects; 3) the interaction of drought, disease, insects, and competition, collectively referred to as decline (e.g., sudden aspen decline); and 4) increased fire intensities as a result of higher temperatures, quicker snowpack loss and reduced stream flow and soil moisture availability, and increased fuels from associated tree mortality. Minor changes could be losses of shade-tolerant, drought-susceptible species, such as white fir, and corresponding favorable conditions for shade-intolerant, drought-tolerant species, such as ponderosa pine.

Timber harvesting also occurs on state, private, Native American tribal and adjacent public lands. Table 3.9.6 estimates the annual average volume of these harvests. No records are kept for private lands harvests (which are generally small in volume, but can, in some cases, contribute considerably to the timber supply). Such contributors to commercial sales are, for example, private land aspen harvests and fire salvage following the Missionary Ridge Wildfire of 2002. In general, however, as harvesting from national forests has fallen, other ownership lands have seen an increase in harvesting volume, particularly in the aspen vegetation type. It is not known how long private lands can sustain the current levels of harvesting.

In relation to SFPs, no significant cumulative impacts were identified under any of the alternatives.

Table 3.9.6: Average Annual Harvest Volume

Entity	Average Annual Harvest Volume (MMCF)
State lands	Small variable quantities
Private lands	Small variable quantities
Southern Ute lands	0.36
Ute Mountain Ute lands	Small variable quantities
Grand Mesa, Uncompahgre, and Gunnison National Forests	2.1
Manti-La Salle National Forest	0.89
Rio Grande National Forest	0.52

3.10 Insects and Disease

3.10.1 Introduction

Natural disturbances (including fire, insects, diseases, and weather events) play a fundamental role in shaping ecosystems and in creating heterogeneous patterns of vegetation at multiple scales. Fire is generally viewed as having the greatest potential to impact the SJNF and TRFO, but in actuality, many more trees are killed—and a larger area is impacted—by insects and disease (Rocky Mountain Region 2010), as evidenced by the pinyon Ips beetle epidemic of 2001–2004, which killed up to 90% of pinyon pine trees in the pinyon-juniper woodlands of southwest Colorado (Colorado Department of Natural Resources 2005), and the ongoing spruce beetle epidemic, which has killed thousands of mature Engelmann spruce trees across the SJNF from 1996 to 2012 (Rocky Mountain Region 2012).

Insects and diseases (which tend to be species-specific and often attack plants that have been weakened by other disturbances such as drought) affect tree growth, fire potential, nutrient cycling, and the composition and structure of vegetation communities (Schmid and Mata 1996). At endemic

levels, native insects have little impact on forest structure. At epidemic levels, insects can cause tree mortality across whole landscapes. Diseases, which often weaken trees, making them more susceptible to bark beetle attack, generally increase gradually or remain at similar levels over time (Rocky Mountain Region 2010). Defoliators, such as western spruce budworm, can cause substantial damage when favorable moisture and stand conditions result in abundant host habitat.

3.10.2 Existing Conditions

Insects that have a significant impact on forest stands on the SJNF and TRFO include spruce beetle, Douglas-fir beetle (*Dendroctonus pseudotsugae*), fir engraver beetle (*Scolytus ventralis*), western pine beetle (*D. brevicomis*), mountain pine beetle (*D. ponderosae*), and western spruce budworm. Other insects that impact the SJNF and TRFO include the Douglas-fir pole beetle (*Pseudohylesinus nebulosus*), western balsam bark beetles (*Dryocoetes confusus*), engraver beetles (*Ips* sp.), roundheaded pine beetle (*D. adjunctus*), pinyon twig beetle (*Pityophthorus* spp.), aspen bark beetles (*Tryphloeus populi* and *Procryphalus mucronatus)*, bronze poplar borer (*Agrilus liragus*), poplar borer (*Saperda calcarata*), western tent caterpillar (*Malacosoma californicum*), large aspen tortrix (*Choristoneura conflictana*), and aspen leaf miner (*Phyllocnistis populiella)*. Grasshoppers (various species) and Mormon crickets (*Anabrus simplex*) can also become pests through periodic population increases.

Diseases that have a significant impact on forest stands on the SJNF and TRFO include shoestring root rot (*Armillaria ostoyae*), Indian paint fungus (*Echinodontium tinctorium*), red ring decay (*Phellinus pini*), white trunk rot (*P. tremulae*), fir broom rust (*Melampsorella caryophyllacearum*), annosus root *rot* (*Heterobasidium annosum*), Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*), southwestern dwarf mistletoe (*A. vaginatum* ssp. *cryptopodum*), pinyon pine dwarf mistletoe (*A. divaricatum*), sooty bark canker (*Encoelia pruinosa*), hypoxylon canker (*Hypoxylon mammatum*), black canker (*Ceratocystis fimbriata*), cytospora canker (*Valsa sordida*), and black stain root fungus (*Leptographium wageneri*).

Within the planning area, insect and disease activity is increasing due to drought, drought-like conditions (due to higher temperatures), and susceptible forest stand conditions. Insect epidemic risk is medium or high throughout much of the planning area, and disease infections are at high levels, so it is likely that there would be continued high levels of tree mortality over the next 15 years. The spruce beetle has killed most of the Engelmann spruce overstory across much of the eastern portion of the SJNF, impacting 111,000 acres from 1996 to 2011 (Rocky Mountain Region 2011). The Douglas-fir bark beetle has caused epidemic-level mortality in large to very large Douglas-fir trees (Eager 2010), affecting thousands of acres of cool-moist and warm-dry mixed conifer forests. Low-elevation aspen forests have experienced rapid tree mortality due to sudden aspen decline incited by drought and increasing susceptibility to typically non-lethal insects and disease, including aspen bark beetles, poplar borers, and cytospora canker (Worrall et al. 2008). Other recent periods of tree mortality on the SJNF and TRFO include the aforementioned pinyon pine die-off in 2001–2004 and the loss of several hundred thousand white fir, on the Pagosa Ranger District alone, due to fir engraver beetle, in 2005–2007. Grasshopper and cricket populations on SJNF and TRFO are currently stable and within endemic levels.

Given abovementioned levels of mortality across most forest cover types, a significant increase in standing and downed dead trees has occurred in mixed conifer, aspen/aspen with conifer, and spruce-fir forests. In recent years, the SJNF has substantially increased the monitoring, and removal, of hazard trees in or near developed facilities or heavily used dispersed sites.

Insect or Disease Management Options

Management activities associated with insects or disease are generally designed to prevent or reduce epidemics by changing the mix of age classes, reducing tree density, promoting habitat diversity, or targeting specific trees for prevention or control. Management activities may include any of the following:

- thinning in ponderosa pine, mixed conifer, aspen with conifer (i.e., thinning the conifer component), or spruce-fir forests to reduce the risk of bark beetle and its associated mortality, reduce infection sources of foliage diseases, reduce habitat for defoliators, and improve vigor in residual trees;
- regeneration harvests in all forest cover types to reduce host habitat for insects and disease, establish vigorous young age classes of trees to ensure age-class diversity;
- sanitation cutting to remove and reduce infection sources for foliage, stem, and root diseases;
- application of pheromone treatments—both attractant and anti-attractant means (pheromone traps or MCH bubble capsules)—to monitor populations or repel bark beetles from high-value trees;
- use of trap tree techniques to reduce spruce beetle populations in select areas;
- use of chemical sprays to repel or kill specific insects on high-value trees (such as in campgrounds);
- use of chemicals to inhibit or kill diseases (such as spreading borax powder on freshly cut stumps); or
- use of prescribed fire to reduce host habitat, thin stands, sanitize diseased foliage (such as scorching of dwarf-mistletoe infected branches or trees).

Many of these techniques can be used in combination to more effectively treat high-risk or infected stands. Some treatments are “coarse” in nature, such as stand- or multi-stand-level thinning or burning and have low to moderate costs per acre. (Typically, on the SJNF and TRFO, activities associated with forest vegetation management—such as timber production, fuels reduction, forest restoration—have incorporated objectives for reducing impacts by insects or disease as well, thereby meeting multiple objectives.) Others are “fine,” such as spraying individual trees with repellent chemicals in developed sites and have relatively high costs; hence, such treatments are meant to be applied to high-value trees on a limited basis.

Management of insects or disease would generally occur to the greatest extent in MA 5, where virtually any activities, listed above, could be applied. Insect or disease management would generally occur to the least extent in MAs 1 and 2 except in stand-, project-, or broad-scale efforts that are designed to coarsely influence forest structure and composition through the use or application of fire on the landscape.

Many of the abovementioned coarse techniques for managing insects or disease meet objectives that closely correspond to objectives for timber management goals (i.e., timber production, sustaining healthy forest conditions, or conditions that benefit other forest resources), fuels reduction, or for meeting broad ecosystem management goals. Hence, associated activities tied to these other resource areas are well integrated with insect or disease treatments.

3.10.3 Environmental Consequences

Direct and Indirect Impacts

Given integration of insect or disease management with silvicultural prescriptions for vegetation management to meet a variety of goals/objectives, impacts across the alternatives would correspond very closely with acres thinned, harvested, or burned (see Volume III, Appendix F for projected acres treated).

The influence of mechanical treatments on insects or disease that affect forests, in context with the forested area across the SJNF and TRFO, is not expected to be great. The projected area thinned/harvested over the 15-year period of the LRMP ranges from 2.5% (Alternative C) to 4.4% (Alternative D). The potential area that could be burned (and concurrently meet insect/disease management objectives) is much greater, but managed fire is not expected to impact a significant area of the forest due to constraints tied to prescribed fire. Hence, effects from insects or disease would tie more closely with forest conditions and affecting factors—that is, 1) amount, extent, and susceptibility of host habitat; 2) insect or disease levels (extent and populations/infection rates); 3) climate; and 4) disturbance (such as windthrow events that create spruce-beetle preferred host material)—than from actual management activities.

The impacts from chemical treatments or pheromone applications for insect/disease are expected to be similar across all alternatives. The majority of these activities would fall in or near developed facilities.

Impacts Related to Fire Management

High-severity, stand-replacement prescribed fire would reduce insect and disease risk to the greatest degree. Low-severity fire that reduces stand density would make stands more resistant to insects and disease. Low-severity fire can weaken the resistance of some trees to insects and disease by damaging root systems and cambial tissues, but these are often the very trees targeted for thinning with prescribed fire.

Alternatives: The extent and frequency of large fires may increase following bark beetle outbreaks that kill many trees. Alternative A allows for less potential managed fire in spruce-fir or “mixed vegetation” (see Volume III, Appendix F). Otherwise, projected prescribed fire is the same for all alternatives.

Impacts Related to Timber Management

Timber harvesting and TSI may provide an opportunity to prevent or reduce insect and disease outbreaks by reducing the density of trees, removing diseased and high-risk trees, and creating forests that are more diverse. The removal of suppressed or dying trees would increase the overall growth and vigor of the remaining trees, which would decrease the susceptibility of those trees to many insects and diseases.

Alternatives: Alternatives that increase the amount, extent, or tree density of mature development stages would generally increase the risk of insect outbreaks or widespread disease. As a result of thinning or harvesting activities, Alternative C would have a slightly greater likelihood of an increased amount and extent of high-risk (for bark beetles) mature-closed development stages, so it would result in a slightly greater risk for insect outbreaks, or widespread disease, than other alternatives. Alternative D would have a slightly lesser likelihood to increase amount and extent of the mature-

closed development stages, so it would result in a slightly lower risk for insect outbreaks or widespread disease. Alternatives A and B fall in between C and D.

Under all of the alternatives, there would be the potential for salvage and/or sanitation cuts designed to harvest dead or damaged trees, which may slow or impede insect increases.

Impacts Related to Recreation

In developed and dispersed recreation sites where trees are often affected by camping activities and where the overall health and vigor of trees is reduced by soil compaction, risk for individual trees to be adversely affected by insects and diseases would increase.

Alternatives: Proposed management affecting recreation, relating to insects or disease, would be the same for all the alternatives.

Cumulative Impacts

Past management practices throughout the planning area, including fire suppression, created forest conditions that are susceptible to insect outbreaks or widespread disease due to higher tree densities and generally older and larger trees, leading to contiguous and homogenous forest stands. These conditions are particularly conducive to bark beetle attacks when coupled with drought-like conditions.

Management actions within the planning area from the implementation of management activities in the revised LRMP and from foreseeable future management activities beyond the 15-year life of the LRMP may create conditions that are less likely to result in insect epidemics or widespread disease in some areas if managed fire, or wildfire, is of significant magnitude to reduce host habitat, particularly forest stands at high risk for bark beetle attack. Given predictions for climate change, drought-like conditions are expected to persist for the 15-year period of the LRMP.

The cumulative impact of past, present and foreseeable future management activities, and present and foreseeable climate change, on federal and non-federal lands within the planning area are expected to result in continued high tree-mortality rates across all forest cover types, large amounts of standing and downed dead trees, high fuel loading, and high-intensity fire in areas of accumulated dead trees. Beneficial aspects would be tied to species that have adapted to these types of disturbances, notably woodpeckers and other birds that feed on bark beetles and wood-boring insects. Also, a wide range of plants normally found beneath coniferous overstories are expected to “release”—that is, vigorously increase in growth as competition and shade from overtopping trees dissipate with elevated rates of tree mortality.

3.11 Fire and Fuels Management

3.11.1 Introduction

Over the past 10 years, the national emphasis on fire and fuels management has increased as a result of large fires, droughts, increasing forest health concerns, and impacts on communities. New policies and laws incorporated in the LRMP alternatives would provide direction to manage wildfires more effectively, reduce hazardous fuels (especially in WUI areas), restore and maintain fire-dependent ecosystems, and promote collaboration with local communities in order to address wildfire-related issues.

Legal and Administrative Framework

Laws

- **The Healthy Forests Initiative and Healthy Forests Restoration Act, August 2002 and 2003:** This act directs agencies to improve the condition of public lands, increase firefighter safety, and conserve landscape attributes valued by society.

Regulations and Policies

- **Federal Wildland Fire Policy, December 12, 1995:** This provides common policies for wildland fire by the USDA and USDI (USDA and USDI 1995).
- **The National Fire Plan, 2001:** This was designed to address five topics: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability. (USDA and USDI 2000)
- **Guidance for Implementation of Federal Wildland Fire Management Policy, February 2009** (USDA and USDOI 2009)
- **Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide** (USDA and USDI 2008)
- I**nteragency Standards for Fire and Fire Aviation Operations** (Red Book) (National Interagency Fire Center 2012)
- **National Cohesive Wildland Fire Management Strategy** (Wildland Fire Leadership Council 2011)

3.11.2 Affected Environment

Existing Conditions and Trends

There is a growing recognition that past land use practices, combined with the impacts of fire exclusion, can result in heavy accumulations of dead vegetation and altered fuel arrangements, as well as in changes in vegetative structure and composition. When dead fallen material (including tree boles, tree and shrub branches, leaves, and decaying organic matter) accumulates on the ground, it increases fuel quantity and creates a continuous supply of fuel. When this occurs, surface fires may ignite more quickly, burn with greater intensity, and spread more rapidly and extensively than in the past. On the other hand, uses such as grazing can sometimes reduce fine fuels, precluding periodic surface fires that would typically burn in these areas. Without fire, encroachment of woody species may occur in some savannah and grassland ecosystems.

In contrast, rather than eliminating fire, exclusion efforts (combined with other land use practices) have, in many places, dramatically altered fire regimes (circumstances of fires including frequency, intensity, and spatial extent) so that today's fires tend to be larger and more severe. No longer a matter of slow accumulation of fuels, today's conditions present the likelihood of more rapid, extensive ecological changes beyond any experienced in the past. Addressing these changes, and the challenges they present, requires understanding and acceptance of the role of wildland fire, and the adoption of land management practices that integrate fire as an essential ecosystem process.

While other management techniques (including mechanical removal) may be used in order to reduce heavy fuels, they cannot always replace the ecological role that fire plays. Fire not only reduces the build-up of dead and downed fuel, it performs many other critical ecosystem functions. Fire can

recycle nutrients that might otherwise be trapped for long periods of time in the dead organic matter that exists in many environments with slow rates of decay. It can also stimulate the production of nutrients and provide the specific conditions (including seed release, soil, light, and nutrients) that are critical for the reproduction of fire-dependent species.

The planning process considers the historic role of fire as an ecological disturbance agent. This knowledge is used to determine the appropriate use of fire and fire surrogate treatments in order achieve desired conditions on the landscape. Numerous studies, locally and across the region, have shown that ponderosa pine forests have missed many fire cycles and are now characterized by dense conditions across the landscape. Reducing fire hazard means thinning the forests and bringing fire back into ponderosa pine forests. In this situation, fuels reduction objectives are in line with restoration objectives. Therefore, in terms of the amount and pattern of thinning and application of fire, prescriptions for fuels reduction projects in ponderosa pine forests would strive to meet restoration objectives.

The opposite situation exists in the pinyon-juniper woodlands, where recent research suggests current dense conditions are typical for pinyon-juniper woodlands (Floyd et al. 2000). Fuels projects designed to mitigate fire hazard in the pinyon-juniper woodlands are driven by public safety concerns. Ecological information about pinyon-juniper woodlands favors development of an overall fuels strategy that minimizes adverse impacts to the overall pinyon-juniper landscape while, at the same time, providing protection in the WUI. The fire and fuels management program would use ecological, social, and economic concerns in order to develop future fire and fuels management strategies.

Fire Regimes

Fire regimes describe the historical ecological role of fire in creating, and maintaining, vegetation communities for a period before Euro-American settlement activities and before active fire suppression began. Fire regimes, or more generally, disturbance regimes, are a key component of HRV characterizations for forest and vegetation types (Volume III, Appendix V, Map 16). HRV reference conditions are useful in developing desired future conditions, which, in turn, can be used as guidelines in developing program strategies and designing fuels restoration projects.

This discussion focuses on fire; however, the role of other disturbance agents is also acknowledged. Fire Regime Condition Class (FRCC) is a standardized interagency tool that utilizes the concept of HRV in order to assess a current landscape's departure from historical (natural) conditions (Hann et al. 2003). The fire regime description includes HRV characterizations of the local forest or vegetation type, and their assigned biophysical group, as defined by FRCC protocol. Fire regimes are typically described by fire frequency, intensity, size, and vegetation type (Heinselman 1981; Sando 1978).

Vegetation types by fire regime are listed in Table 3.11.1 based on FRCC definitions (Hann et al. 2003). Each existing vegetation type has experienced a characteristic pattern of succession and natural disturbances (including fires and insect outbreaks) that occurred at varying intervals and characteristic intensities. These natural disturbances were key to maintaining a diversity of seral communities and, therefore, a variety of plant and wildlife habitat across the landscape.

Table 3.11.1: Historic Fire Regimes for the San Juan National Forest and Tres Rios Field Office

Fire Regime Class	Frequency (fire return interval)	Severity	Existing Vegetation Types	Acres of SJNF and TRFO	Percentage of SJNF and TRFO
I	0–35+ years, frequent	Predominantly low	Ponderosa pine	411,790	11%
			Warm-dry mixed conifer	95,392	3%
II	0–35+ years, frequent	Replacement	Mountain grasslands	304,314	8%
			Semi-desert shrubland	95,380	3%
			Sagebrush shrublands	210,030	6%
III	35–100+ years, less frequent	Mixed and low	Cool-moist mixed Conifer	199,412	6%
IV	35–100+ years, less frequent	Replacement	Aspen	346,384	10%
			Mountain shrubland	450,190	12%
			Semidesert grassland	301,538	8%
V	200+ years	Replacement and other fires occurring within this frequency range	Spruce-fir	510,220	14%
			Pinyon-juniper woodland	444,147	12%
			Alpine	186,494	5%

Fire Regime Condition Class

The first step of FRCC characterizes HRV conditions for vegetation types. These are the reference conditions used to assess whether a landscape (forest type) is outside its HRV. The second step of FRCC is an assessment of a landscape's degree of departure from its HRV conditions. For the SJNF and TRFO, the reference period for this analysis spans the seventeenth century to the late nineteenth century. This period is based on the most reliable span in fire history data. The reference period is the time period when ecosystems, along with their natural disturbance regimes, were still intact and functioning in sustainable landscapes (before Euro-American settlement activities). Tree-ring fire chronologies show the last widespread fire occurred in the 1880s. The year 1890 is a good date to designate the beginnings of fire exclusion (Brown and Wu 2005; Grissino-Mayer et al. 2004; Wu 1999). Current condition departure assessments are based on missed (or increased) fire occurrences, uncharacteristic fire behavior, current species composition, structural stage, age and canopy closure, and fuel accumulations compared to conditions under the historic disturbance regimes.

Table 3.11.2 defines the three FRCC condition classes. Low departure (FRCC 1) is considered to be within HRV. Moderate departure (FRCC 2) indicates that components of the fire regime (including fire frequency) have been altered, resulting in changes in vegetation and landscape patterns. These areas may require varying levels of management actions before fire can be restored and allowed to play its historical natural role.

High departure (FRCC 3) means that fire regimes and vegetation are significantly altered from historical conditions. Uncharacteristic fire behavior and fire impacts would occur under certain conditions. This would result in vegetation composition and assemblages not known to exist during reference conditions. (FRCC is a calculated number and the protocols are outlined in the FRCC Guidebook, Volume 1.2 [Hann et al. 2003]. However, the SJNF and TRFO condition class assigns FRCC values based on a vegetation polygon's type and fire regime, and would be updated with the new FRCC map [Volume III, Appendix V, Map 17]).

Table 3.11.2: Fire Regime Condition Class Descriptions

Condition Class	Descriptions
FRCC 1 Low departure	Fire regimes are within the historical range and the risk of losing key ecosystem components is low. Vegetation attributes (including species composition and structure) are intact and functioning within their historical range.
FRCC 2 Moderate departure	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This may result in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
FRCC 3 High departure	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This may result in dramatic changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

Table 3.11.3 shows each major vegetation type by its assigned FRCC. In general, ecosystems with the longest return fire intervals (including spruce-fir and pinyon-juniper) have not missed fire intervals and, therefore, on a stand level, their structure and species composition is well within estimated HRV conditions. From an ecological perspective, fires can be allowed to burn in these forests under any conditions and would burn with characteristic intensity and with characteristic impacts. Some concerns about landscape structure and mosaic exist and need to be assessed. However, due to the long fire intervals, the landscape is probably still within HRV. Spruce-fir is in FRCC 1 and pinyon-juniper is in FRCC 2. Even though its fire regime and macro woody structure is intact, pinyon-juniper is only considered FRCC 2 because of grazing, chainings, and degraded herbaceous composition. Over time, the current cheatgrass invasion may push pinyon-juniper to FRCC 3. Cheatgrass cover would introduce frequent surface fire to this low frequency-high intensity fire regime and alter post-fire successional pathways.

Table 3.11.3: Fire Regime Condition Class by Existing Vegetation Type

FRCC (assigned)	Existing Vegetation Type	Acres of Public Lands	Percentage of Public Lands
1	Spruce-fir	510,220	14%
	Alpine	186,494	5%
	Aspen	346,384	10%
2	Cool-moist mixed conifer	199,412	6%
	Mountain grasslands	304,314	8%
	Mountain shrublands	450,190	12%
	Pinyon-juniper woodlands	444,147	12%
	Semidesert grasslands	301,538	8%
	Semidesert shrublands	95,380	3%
	Sage shrublands	210,030	6%
3	Ponderosa pine	411,790	11%
	Warm-dry mixed conifer	95,392	3%
0	Riparian and wetland	77,964	2%

Aspen is currently assigned to FRCC 1 but is trending toward FRCC 2. The current distribution and age structure across the landscape is an assemblage within HRV; however, it appears to be on the

longer extreme of its HRV. Many stands succeeding to conifer would benefit from burning in order to regenerate the stands. An important question to aspen persistence on the landscape is how long a clone can remain viable after its last stand replacement fire.

Cool-moist mixed conifer is assigned to FRCC 2 because, although it has missed some fire intervals, its vegetation composition and landscape mosaics are still within HRV (with fires still behaving characteristically and producing characteristic impacts). This is true for the other vegetation types listed in FRCC 2; however, the semi-desert vegetation and sagebrush types are threatened by cheatgrass and other noxious weeds, and have the same situation described for pinyon-juniper.

Ponderosa pine and warm-dry mixed conifer are both frequent surface fire regimes and have been the most affected by fire suppression, logging, and grazing since Euro-American settlement; therefore, they are assigned to FRCC 3. They have missed numerous fires relative to historic patterns, and as a result their stand structures are overly dense, their understory herbaceous life is degraded, and white-fir is overtaking ponderosa pine in the warm-dry mixed conifer types. Forest fire regimes have shifted from high frequency, low intensity surface fire to low frequency, high intensity stand-replacement fire.

Fire Hazard

Fire hazard is directly related to vegetation or fuel conditions (including type of vegetation, age, structure, density, and amount of live and dead material), topography (including slope, aspect, and elevation), and weather conditions (including wind speed and direction, and fuel moisture). These elements all impact fire behavior, as well as the intensity and rate of spread of fires. Fire hazard changes with changing conditions.

Fire hazard for the planning area was modeled for current vegetation conditions (topography is considered to be constant) under the 97th percentile weather conditions. This is based on weather data taken from the remote automated weather stations located throughout the planning area. Data were summarized from 1990 to 2011. Modeled weather conditions included wind gusts of 23 miles per hour, generally coming from the west and southwest.

Historic Fire Activity

Historic fire activity records, from 1980 through 2011, were evaluated for the planning area. Table 3.11.4 summarizes the number of fires, the causes, and the number of acres burned for each year. Map 18 (Volume III, Appendix V) displays fire start locations and causes for this same period. Only fires that burned within the planning area are included.

Table 3.11.4: Fire Activity on the San Juan National Forest and Tres Rios Field Office, 1980–2011

Year	Lightning Caused		Human Caused		Total Fires	
	Number of Fires	Acres Burned	Number of Fires	Acres Burned	Number of Fires	Acres Burned
1980	64	141	13	22	77	163
1981	65	43	8	9	73	52
1982	36	47	4	0	40	47
1983	27	5	11	7	38	12
1984	35	13	3	0	38	14
1985	47	170	4	3	51	173
1986	25	10	5	17	30	26
1987	34	832	18	345	52	1,177

Year	Lightning Caused		Human Caused		Total Fires	
	Number of Fires	Acres Burned	Number of Fires	Acres Burned	Number of Fires	Acres Burned
1988	66	121	10	248	76	370
1989	145	723	33	241	178	964
1990	80	1,370	11	19	91	1,388
1991	58	38	15	100	73	138
1992	34	28	14	13	48	41
1993	41	16	17	9	58	24
1994	186	2,119	12	320	198	2,439
1995	60	548	12	12	72	560
1996	171	4,724	15	704	186	5,428
1997	46	77	9	6	55	83
1998	70	1,769	13	46	83	1,815
1999	23	9	13	7	36	15
2000	203	1,658	19	122	222	1,780
2001	67	780	11	104	78	885
2002	113	75	25	74,123	138	74,198
2003	246	4,265	7	9	253	4,274
2004	128	673	14	62	142	735
2005	76	4,485	7	1	83	4,486
2006	175	78	17	4	192	82
2007	120	359	20	5	140	365
2008	61	332	32	136	93	468
2009	84	9,762	19	3	103	9,765
2010	67	96	26	10	93	106
2011	82	147	33	153	115	299
Total	**2,735**	**35,513**	**470**	**76,860**	**3,205**	**112,372**
% of Total	**85%**	**32%**	**15%**	**68%**	**100%**	**100%**

Prescribed Burns and Fuels Reduction Treatments

The planning area uses prescribed burns and mechanical treatments in order to achieve multiple objectives, including hazardous and natural fuels reduction, wildlife habitat improvement, ecosystem restoration, and range betterment. Smoke management has always been a challenge for SJNF and TRFO managers, especially in the fall when many days of poor smoke dispersion are forecasted by the National Weather Service. Fire managers work closely with the National Weather Service and the CDPHE and use a multitude of methods in order to reduce the amount of smoke in the various airsheds.

On NFS lands, approximately 8,500 to 10,500 acres of hazardous fuels are treated annually, primarily through prescribed burning. Mechanical treatments have occurred only in the last several years and constitute approximately 30% of the overall fuels program. Since 1974, the USFS has treated approximately 141,000 acres of hazardous fuels, excluding wildfires and fire managed for resource benefit.

Since 1999, the BLM has treated approximately 2,000 to 3,000 acres of hazardous fuels annually, primarily by mechanical means (including hydro-mowing and hand-thinning) with small amounts of prescribed burning. Most fuels reduction has occurred within the WUI and FRCC 3 vegetation. Since 1990, the BLM has treated roughly 20,000 acres of hazardous fuels, excluding wildfires and fire managed for resource benefit.

Fire in the Wildland Urban Interface

For the SJNF and TRFO, much of the focus on reducing fire risk is on the WUI areas, where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The identified WUI within the planning area is displayed in Map 19 (Volume III, Appendix V). This includes communities-at-risk (as identified in the *Federal Register* 66(3):751–754, January 4, 2001), as well as other private lands where housing density is greater than one structure per 40 acres, buffered by 1.5 miles. The relative risk to all of these WUI areas varies depending on location, slope, aspect, surrounding vegetation (fuel conditions), and type and density of the development. These risk factors must be considered in developing treatment strategies and priorities for these areas, in cooperation with other local partners (including counties, communities, the Colorado State Forest Service, the NPS, the Bureau of Indian Affairs [BIA], and landowners).

Within the planning area, use patterns on private lands in and around the public lands have been changing from what was historically livestock ranching (with little structural development) to subdivided residential areas. This presents a management challenge that is occurring throughout the area encompassed by the public lands. These changes have increased the risk factors associated with fire management in and around these WUI areas.

Fire Management and Coordination Efforts

Fire management in the region is coordinated between multiple agencies through the Durango Interagency Dispatch Center, which serves the SJNF and TRFO, Mesa Verde National Park, and the Southern Ute Agency and the Ute Mountain Ute Agency of the BIA, as well as the surrounding 12 counties. The dispatch center provides support for initial attack and large incidents, and oversees air operations (e.g., air tankers, smokejumpers, and helicopters).

Since the mid-1990s, fire management policy has evolved beyond just suppression actions to include a variety of management options, as described in the National Fire Plan. The four primary goals of the National Fire Plan include improving fire prevention and suppression, reducing hazardous fuels, restoring fire-adapted ecosystems, and promoting community assistance.

Fire management policy differs between the various agencies and landowners (the USFS, BLM, NPS, State of Colorado, and private property owners) that have jurisdiction in the region. Wildfires on private lands are suppressed by rural and county fire departments. Full suppression of fires is the goal of these agencies. The SJNF and TRFO have general categories of treatment guiding fire management and fuels treatment. The LRMP, Volume II allows the use of prescribed burns and fire managed for resource benefit under the following emphasis areas:

- **Fire Suppression:** This includes areas where wildfire is not desired. Without mitigation, unplanned ignitions may have adverse impacts on resource values (including WUI lands, cultural resources, and areas with unnatural fuels build-up). Fire suppression would be aggressive. However, prescribed burns and/or mechanical treatments may be considered in order to reduce hazards when resource concerns can be mitigated.
- **Fire Suppression with Fuels Treatment:** These include areas where fire is desirable; however, social, economic, and ecological constraints must be considered (including state air quality emission standards, and wildlife species and habitats). A variety of suppression efforts may be used. Prescribed fire and mechanical fuels reduction treatments are acceptable tools for meeting resource objectives.

- **Fire Managed for Resource Benefit with Constraints:** These include areas where fire is desired and where there are few resource constraints to its use. Fires may be managed under a fire managed for resource benefit strategy, which allows a full range of management responses. Prescribed fire and mechanical fuels reduction treatments are also acceptable tools for meeting resource objectives.
- **Fire Managed for Resource Benefit:** These include areas where fire is desired and where there are few resource constraints to its use. Applying a fire managed for resource benefit strategy allows a full range of management responses to meet desired goals and objectives for resource management. Prescribed fire and mechanical fuels reduction treatments are also acceptable tools for meeting resource objectives.

Areas where the four categories described above would be applied have been identified and are displayed in Map 19 (Volume III, Appendix V).

Fire Managed for Resource Benefit

Fire managed for resource benefit is defined as the application of the appropriate management response to naturally ignited wildland fires in order to accomplish specific resource management objectives in predefined designated areas outlined in fire management plans. Wildland fires would be used in order to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in their natural ecological role. Use of fire would be based on approved fire management plans and would follow specific prescriptions contained in operational plans.

In 1997, the SJNF was the first public lands office in the state, or in the Rocky Mountain region, to initiate a fire managed for resource benefit program via an EA. Since that time, the program has evolved throughout most federal land management agencies and can be used if fire managed for resource benefit is part of an approved fire management plan, and it is consistent with local LRMPs.

Key Findings

- The five historic fire regimes distribution on the SJNF and TRFO are: I = < 1%, II = 22%, III = 25%, IV = 5%, and V = 41%. Water and bare/rock areas that do not burn make up the remaining 7%.
- Since 1980, 2,183 wildfires have occurred on NFS and BLM lands, burning 99,672 acres. Approximately 87% were caused by lightning and 13% were human-caused. Most of these fires were very small (74% were less than 0.25 acre, and 21% were between 0.25 and 10 acres), accounting for 1.2% of the total area burned. The Missionary Ridge Fire accounts for 73% of the total burned area.
- Based on 25 years of fire history, the planning area is at a relatively moderate risk for fire occurrences.
- WUI areas occur on approximately 25% of the public lands.

Management Challenges

Over the past 30 years, the trend in acres impacted by fire is related to trends in vegetation conditions, including increasing age, density, and fuel loading in all woodland and forest cover types. Specific examples of this trend are found in the ponderosa pine zone, with dense canopy cover and heavy oak brush ladder fuels and the pinyon pine/Utah juniper woodland, which has witnessed intense beetle kill and an invasion of fast-burning cheatgrass. These conditions have the potential to

allow fires to spread to larger areas and burn with higher intensities than would have occurred historically.

Fire size trends are also related to weather conditions. Drought conditions not only stress vegetation, making it more susceptible to insect attack and mortality, but also result in increases in drought-caused mortality. The result is increasing amounts of dead fuel building up within the planning area.

Development of private land within public land boundaries is dramatically increasing as land use changes from livestock ranching to subdivisions.

3.11.3 Environmental Consequences

Direct and Indirect Effects

All of the alternatives use wildland fire in order to maintain public land conditions within the HRV while, at the same time, recognizing that other resource and social values may determine the appropriate management responses. Use of managed fire, along with mechanical and other fuels management strategies, may create forest conditions that meet desired conditions for the natural vegetation types within the planning area. Recognizing that effective fire management spans jurisdictional boundaries, the fire and fuels program would also use partnerships and assist local counties and communities in developing community wildfire protection plans in order to reduce the risk of wildfires.

Acres of Fuels Treatment by Alternative

Estimates were made of the number of acres of fuels treatment attainable annually under each alternative. These estimates were based on values at risk, historic funding levels experienced by the public lands over the last few years, and management objectives for each alternative. The highest priority for mechanical treatments would continue to be adjacent to high-value areas, communities at risk, and areas identified in community wildfire protection plans.

Fires in long return interval fire regimes are typically high-intensity, stand-replacing fires; therefore, fuel treatments adjacent to high-value areas would likely concentrate on defensible space. Among the high-value areas within the planning area are communities, primary residences, summer homes, campgrounds, administrative sites, ski areas, and areas of high-resource values. All fuel breaks created would require maintenance. The type and interval of the maintenance would be determined through project-level planning. The highest priority for use of prescribed burns would be in fire regimes I, II, and III (with FRCC of 2 or 3), and for maintenance of condition class. Prescribed burns would be safely implemented in order to reduce fuel hazard adjacent to high-value areas (with those areas receiving preference). It is important to note that while prescribed burning results in benefits to the fuels profile and/or to the FRCC, often a goal of the burn would be to improve wildlife habitat or range condition for domestic livestock.

Based on the current budget trends and known capability to achieve fuels treatments for the SJNF and TRFO, a yearly target of approximately 13,000 acres of combined mechanical and prescribed burns would be the average for the future. (This average could change, based on budget, environmental conditions, and approved burn plans.) Alternatives A through D have different MA delineations; however, this may not measurably impact the amount of treatments and acreage completed (because treatments may simply be located elsewhere).

Fire managed for resource benefit is the most natural disturbance process for the land. Due to its unpredictable nature, the amount of acres impacted by fire managed for resource benefit cannot be estimated accurately. The statements below, as presented in the LRMP as desired conditions, indicate the amount of fire managed for resource benefit that could be effectively managed in any given year. See also Table 3.11.5 and Table 3.11.6.

- For the next 10 years, complete an average of 8,000 acres of hazardous fuels reduction in the WUI each year.
- For the next 10 years, complete an average of 5,000 acres of fuels reduction and resource enhancement within the planning area each year.

Table 3.11.5: Average Acres of Fuels Treatment by Cover Type per Year on San Juan National Forest Lands

Fuels Treatment	Alternative A	Alternative B	Alternative C	Alternative D
Pinyon/Juniper	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire	1,000 acres mastication 500 acres prescribed fire
Mixed Shrubland	2,000 acres mastication 1,000 acres prescribed fire	2,000 acres mastication 1,000 acres prescribed fire	2,000 acres mastication 1,000 acres prescribed fire	2,000 acres mastication 1,000 acres prescribed fire
Ponderosa Pine	1,000 acres mastication 3,500 acres prescribed fire 500 acres mechanical restoration	1,000 acres mastication 3,500 acres prescribed fire 500 acres mechanical restoration	1,000 acres mastication 3,500 acres prescribed fire 500 acres mechanical restoration	1,500 acres mastication 3,500 acres prescribed fire 500 acres mechanical restoration
Warm Dry MC	1,000 acres prescribed fire 500 acres mechanical restoration	1,000 acres prescribed fire 500 acres mechanical restoration	1,000 acres prescribed fire 500 acres mechanical restoration	1,000 acres prescribed fire 500 acres mechanical restoration
Mixed Vegetation	1 to 20,000 acres fire managed for resource benefit	1 up to 50,000 acres fire managed for resource benefit	1 up to 50,000 acres fire managed for resource benefit	1 up to 50,000 acres fire managed for resource benefit
Spruce-fir	1 to 20,000 acres fire managed for resource benefit	1 up to 50,000 a acres fire managed for resource benefit	1 up to 50,000 acres fire managed for resource benefit	1 up to 50,000 acres fire managed for resource benefit

Table 3.11.6: Average Acres of Fuels Treatment by Cover Type per Year on Tres Rios Field Office Lands

Fuels Treatment	Alternative A	Alternative B	Alternative C	Alternative D
Pinyon/Juniper	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire
Mixed Shrubland	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire	500 acres mastication 500 acres prescribed fire

Fuels Treatment	Alternative A	Alternative B	Alternative C	Alternative D
Ponderosa Pine	500 acres mastication 500 acres prescribed fire 200 acres mechanical restoration	500 acres mastication 500 acres prescribed fire 200 acres mechanical restoration	500 acres mastication 500 acres prescribed fire 200 acres mechanical restoration	500 acres mastication 500 acres prescribed fire 200 acres mechanical restoration
Warm Dry MC	500 acres prescribed fire 500 acres mechanical restoration	500 acres prescribed fire 500 acres mechanical restoration	500 acres prescribed fire 500 acres mechanical restoration	500 acres prescribed fire 500 acres mechanical restoration
Mixed Vegetation	1 up to 10,000 acres fire managed for resource benefit	1 up to 10,000 acres fire managed for resource benefit	1 up to 10,000 acres fire managed for resource benefit	1 up to 10,000 acres fire managed for resource benefit
Spruce-fir	1 up to 10,000 acres fire managed for resource benefit	1 up to 10,000 acres fire managed for resource benefit	1 up to 10,000 acres fire managed for resource benefit	1 up to 10,000 acres fire managed for resource benefit

Acres Burned by Wildfire

It is very difficult to predict the number of acres that would be burned by wildfire in future years. Conditions that dictate the severity of fire seasons tend to vary significantly year to year. Weather, which is the primary influence on availability of fuels for ignition, is very difficult to predict with any degree of reliability more than a few days into the future. Research suggests that large stand-replacing fires are more likely to occur as the result of weather conditions than of fuel accumulations. Most large fires occur in years with elevated weather variable values, and fires in those years account for the majority of the area burned. Prediction of major influences (including the occurrence of drought) is improving, but is still not very reliable. For these reasons, the best method for predicting the acreage that would burn in the future is to base the prediction on historical fire occurrence.

Large fires within the planning area are frequently the result of wind events and account for considerable fire spread in a relatively short period of time. The growth and spread of large fires are influenced by the presence of closed canopy forests, especially those with dense ladder fuels (including oak brush and white-fir). Much of the pinyon-juniper woodland burns under the effects of wind, but usually loses its energy after one or two burning periods. It is difficult to predict the number of acres that would burn in wildfires in the future; however, it is reasonable to expect that large fires would continue to occur within the planning area, as they have historically, when weather and fuel conditions are conducive for large fire growth. Some of these fires may involve significant acreages.

Anticipated Relative Wildland Fire Cost Analysis

Through all alternatives, the relative consequence of implementation of fuels treatments and the effectiveness of firefighting resources would have both short- and long-term effects on fire protection and suppression objectives. Fire suppression costs under all alternatives are likely to increase over the life of the LRMP as more homes and infrastructure are built in the WUI. However, the costs associated with fuels project implementation, adding fire resources, and protecting values at risk would be higher at first, then level off as time and treatments provide remedy to risk.

Under Alternative A:

In the short term, the increase in mechanically treated surface fuel from vegetation treatments could result in increased suppression costs compared to baseline conditions. In the long term, management objectives to decrease standing vegetation and overall fuel loading would result in lowered suppression costs.

Under Alternative B:

Overall, vegetation management objectives focused on reducing fuel loads and flexibility in the use of planned and unplanned fires under Alternative B are likely to resulting in the lowest long-term fire suppression costs of any alternative.

Under Alternative C:

Overall, fire suppression costs under Alternative C are likely to be highest of all alternatives in the long term due to reduced flexibility in management, and a reduction in mechanical fuels treatments in the planning area.

Under Alternative D:

Overall fire suppression costs under Alternative D are likely to be similar to that in Alternative A. Suppression costs could be slightly increased due to the higher potential for ignition due to increased human activities in the area.

Impacts Related to Timber Management

The fuel profile, and subsequent fire behavior, would be impacted in sites where timber harvesting occurs. Impacts to the fuel profile and fire behavior may be both positive and negative. Surface fuel loading, crown base height and crown bulk density are the primary stand attributes influencing crown fire initiation and spread. Depending on the silvicultural system being implemented, timber harvesting may impact each, or all, of these attributes. At a minimum, with a silvicultural system that thins the timber stand, crown bulk density may be reduced, which may, in turn, impact the potential for the spread of fire through the canopy within the treated stands. After such a timber harvest, a fire may transition into the crowns of individual trees (known as passive crown fire or torching), but movement of fire through the canopy (known as active or independent crown fire) would be inhibited through reduced crown bulk density.

When the intensity of a surface fire exceeds a critical level, fire can spread vertically into the canopy. Ground fuels in the form of slash would be temporarily increased as a result of timber harvesting, but the manner in which slash is treated after harvesting may play a major role in potential surface fire intensity. Treatment of the slash by various methods (including piling, lopping, scattering, and burning) would mitigate much of this impact by reducing available fuels, which, in turn, may reduce the potential intensity of surface fires.

Timber harvesting units may affect the spread of fire across the landscape; however, the extent of this impact would depend on the size of the harvesting units, the location of units in proximity to fire spread, and the intensity of the fire. High-intensity, stand-replacing fires would most often involve spotting well ahead of the fire front, in which case, timber harvesting units may have little to no effect in slowing or stopping fire progress. In the case of a smaller, less intense fire, treatment units could serve to slow the fire’s advance. Harvesting units may also provide anchor points for fireline

construction, and safety zones for fire suppression resources for a period of time after slash is treated.

Timber harvesting operations and associated road construction may present a slightly increased potential for fire occurrence caused by mechanized equipment and other increased activity in the short term (while operations are in progress). Thus, the more timber harvests implemented, the greater the potential for these types of human-caused fires. Timber sale contracts include clauses that address fire prevention and suppression, which would mitigate most of the potential human-caused fires.

Since timber harvesting may have some long-term beneficial impacts in regard to fuels reduction, the alternatives with the highest projected allowable wood-fiber removal may result in the greatest benefit. These alternatives may also have a slightly higher, short-term, human-caused fire risk (due to equipment operation, slash generation, and a drier microclimate created by harvesting). Benefits due to fuels reduction may be greatest under Alternative A, followed by Alternatives D and B. These benefits may be minor under Alternative C, which would emphasize natural processes in order to sustain ecological systems.

Impacts Related to Travel Management and Recreation

Historically, fires within the planning area were not accessible by road, but this varied between the west zone of the SJNF and TRFO (which has a denser road system) and the central and east zones (which are more remote). Roads can aid in fighting fires by providing ground access to the wildfires and access for fuel treatments. However, they also provide access for recreation use, which, in turn, may increase the potential for human-caused ignitions. Increased human use of the planning area may also result in faster reporting of fires, which, in turn, may result in fewer acres burned. Roads can serve as anchor points for fireline construction by suppression forces and can also serve as barriers to the spread of low-intensity fires. High-intensity fires would likely exhibit extreme radiant heat and spotting well ahead of the fire front. This may make roads ineffective as barriers to high-intensity fire spread. For less intense fires, roads can be an effective barrier to fire spread. When a fire is accessible by road, response times for initial attack are reduced, and road access during extended attack improves logistics (thus reducing costs) of managing fires.

Alternative D may increase the miles of roads within the planning area, resulting in both the positive impacts of better access to manage fires and the adverse impacts of a higher risk of human-caused fires. Recreation use of the public lands is expected to increase over the next few decades, regardless of the road or trail density or alternative chosen. Alternative C may decrease road miles, which may result in positive impacts (by decreasing human use and the chance for human-caused ignitions) and adverse impacts (by reducing accessibility for firefighting equipment). Overall, none of the alternatives may result in a substantial increase, or decrease, in the existing road density; therefore, there would likely be a negligible change in current conditions related to the number of new fire starts.

Impacts Related to Wilderness Areas, Wilderness Study Areas, and Research Natural Areas

There are two objectives of fire management in wilderness areas: 1) to permit lightning-caused fires to play their natural ecological role within wilderness areas as much as possible, and 2) to reduce, to an acceptable level, the risks and consequences of wildfire within wilderness areas or escaping from the wilderness (FSM 2324.21). BLM Manual H-8550-1 (BLM 1995) states that WSAs should be

managed in order to preserve their wilderness characteristics. From a fire standpoint, WSAs would be managed as if they were wilderness areas.

With the implementation of the final approved LRMP, fire management strategy would occur in accordance with the fire management plan, operational (fire managed for resource benefit) plans, and individual wildland fire implementation plans. Although fire managed for resource benefit may be desirable in the wilderness areas, WSAs, and RNAs, it is possible that it may not be applicable in some of these areas (due to the size of the area, the proximity to high-value areas, or to the unbroken expanses of fuels leading to areas of high-value resources or improvements). High-value areas represent a wide range of values, from private property to areas that are of high resource value for watersheds, to areas with high historic values. All areas would be evaluated based on the local situations, values to be protected, management objectives, and external concerns. Small areas are often not feasible for application of fire managed for resource benefit. This would be due to the potential for the fire to move into areas where fire managed for resource benefit is not desired. In general, the larger the area, the more feasible it would be to implement fire managed for resource benefit. For any fires requiring suppression within designated wilderness areas, the logistics may be more difficult and the cost of suppression may be higher than in other areas. This would be due to restrictions on the use of mechanized equipment and access limitations.

These impacts may be offset by reduced costs associated with fire managed for resource benefit (instead of expending funds for suppression) and by the resource benefits derived from allowing fire on the landscape. Through implementation of fire managed for resource benefit, fire would be allowed to play its natural role in the ecosystem, which may, in turn, restore, improve, or maintain the health of the ecosystem. Plant species that regenerate through fire, as well as animal species that require snag habitat, may benefit from implementation of fire managed for resource benefit and prescribed burns. Areas in which fire managed for resource benefit fires actually occur may be less likely to experience fuels build-up that result in uncharacteristically intense fires, which, in turn, may result in losses of key ecosystem components.

Alternatives with the most lands in wilderness areas, WSAs, and RNAs may provide the greatest opportunity for allowing fire managed for resource benefit and, consequently, may yield more of the benefits associated with fire managed for resource benefit and prescribed burns. Alternative C would propose the greatest amount of MA 1 (where natural processes dominate) with the inclusion of additional RNAs. Alternative C would provide the greatest opportunity for fire managed for resource benefit and its benefits, followed by Alternatives B and D. However, such opportunities would be reduced under Alternative A (which would result in more developed areas and infrastructure where the use of natural fire is generally less feasible).

Impacts Related to Livestock Grazing and Big Game Use

Grass and forbs are the primary carriers of surface fire in open forested areas, shrublands, and grasslands; therefore, grazing (by domestic livestock and, to a lesser degree, wildlife) may have the effect of reducing fire intensities by reducing available fuels. The degree to which fire intensities may be reduced would be dependent on how much grass and forb production is removed through grazing. Grazing may also have an impact on the ability to successfully implement prescribed burns. For example, it is sometimes necessary to rest an area from livestock grazing for a season prior to burn implementation in order to have sufficient grass to carry the fire.

Grazing would continue to have the most effect on reducing fire behavior in fire regimes I, II, and IV (which includes ponderosa pine, grass communities, and shrublands). Fire regime III (which includes Douglas-fir and a moister climate) does not generally produce heavy grass/forb fuel loads due to

predominantly wet sites along with cooler temperatures. Fire regime V (which includes long-interval fire regimes with dense pinyon-pine/juniper, spruce, and subalpine-fir) has a minimal grass/shrub component and may, therefore, notice little impacts related to grazing. In aspen stands, grazing impacts the understory and may limit regeneration.

The level of livestock grazing would be very similar between all of the alternatives; therefore, the impacts related to grazing on fire and fuels may be nearly identical under all of the alternatives.

Impacts Related to Insects and Disease

Insect and disease outbreaks in forested communities impact the fuels profile and have a subsequent effect on fire behavior and fire-suppression activities. The extent of the impacts from dead and dying trees would depend on the scope of the infestation. Small endemic occurrences of insect infestations or disease may have little or no impact on fire behavior or suppression activities; however, epidemic or large-scale outbreaks may result in major impacts. Both types of outbreaks have naturally occurred within the planning area throughout time.

When tree mortality occurs as a result of insects or disease, the needles die; however, they may persist on the branches for several years. The length of time the needles persist depends on the tree species. This creates a situation conducive for transition from surface fire to the canopy, and possibly fire spread through the canopy. Among the variables determining whether a fire remains on the surface or transitions to a crown fire include surface fire intensity, vertical fuel arrangement (availability of ladder fuels), and crown flammability (live foliar moisture or fine dead-fuel moisture). In a healthy stand, during normal climate conditions, foliar moisture content is relatively constant, averaging about 100%. However, when a tree dies, the dead needles respond to climate as a 1-hour fuel. It is common for 1-hour fuel moistures to drop to 4% and, occasionally, lower during periods of hot temperatures with low relative humidity. As a result, a dead tree with needles still attached to the branches is much more susceptible to torching than a live green tree. Whether the fire, after transitioning into the crowns, becomes an active crown fire in which the fire moves independently through the crowns is dependent on the crown spacing. Stands in which crowns are closely spaced are more likely to sustain active crown fire than would open-stand conditions.

As time passes, the needles gradually fall from the trees and eventually become part of the duff layer. In the short term, this adds to the surface fuel loading. However, since it occurs over a relatively long period of time, the impact is gradual and is mollified as the needles become compacted and, thus, less available to burn.

Although the smaller fuels (as described above) are the most important in regard to fire intensity at the flaming front, large fuels are also impacted. Dead trees eventually fall to the ground, often as a result of wind. This greatly increases the fuel loading; however, it does not substantially increase the fire intensity at the flaming front. The primary importance of this increase in large down fuels is an increase of intensity following the passage of the flaming front. This equates to a longer residence time, influencing fire impacts. Probably the greatest impact related to increased loading large down fuels is in resistance to control during suppression operations. These heavy down fuels can generate considerable intensity, making direct fireline construction infeasible and inhibiting the line-building process. Standing dead trees or snags are a recognized safety hazard in suppression activities. This is due to the possibility of the snags falling on firefighters, as well as to their propensity for showering embers across firelines (thereby increasing the potential for spot fires).

Alternatives emphasizing timber management, such as Alternative D, may have the highest potential to limit the spread of insect or disease outbreaks (by the harvesting of diseased or insect-infested

trees, and stands at high risk for disease or insect problems, where stands are accessible). These alternatives may also have the most potential to harvest dead and dying trees before they accumulate into a hazardous fuels problem. Alternatives emphasizing timber management may have more potential to salvage dead trees. This would limit fuels build-up from insect and disease mortality, which may, in turn, reduce resistance to control of fires. Alternatives with the lowest projected levels of timber harvesting may have the most potential for insect and disease mortality (adding to fuel loadings due to less salvage harvesting). Alternative A would have the highest wood-fiber removal and, therefore, may have the greatest benefits for managing insects and disease, followed by Alternatives D and B. These benefits may be the least apparent under Alternative C, which would emphasize natural processes.

Impacts Related to Noxious and Invasive Species

Increases in fire activity (wildfire and/or prescribed burns) may result in increasing noxious weed spread (due to disturbance from the fires directly and from fire-suppression operations). Additionally, stand-replacement fires create conditions conducive to invasion of noxious weeds if seed sources are present. Wildfire severity and occurrence are largely a function of weather (which cannot be accurately predicted more than a few days into the future) and subsequent fuel conditions. It is not possible to predict differences in wildfire occurrences or sizes of fires between alternatives; therefore, the potential for invasive species spread must be based on other criteria. Alternatives with the most potential for fire managed for resource benefit may have more potential for disturbance from fires. However, they may have less potential for disturbance from suppression actions. Fuel treatments can create disturbance, which may, in turn, lead to the spread of noxious/invasive species with the presence of a seed source; therefore, those alternatives with the highest level of fuel treatment may present the greatest potential for noxious weed spread. When all of the above factors are taken into consideration, there may be is a negligible difference between alternatives in respect to their impacts on noxious and invasive species.

Cumulative Impacts

Fire-suppression activities have changed fire regimes and FRCC, particularly in ponderosa pine, pinyon-pine/juniper, sagebrush, and warm-dry mixed conifer types (see Volume III, Appendix K).

Large catastrophic fires occurring during recent drought years have stressed the need to treat wildland fuels in order to reintroduce fire into fire-adapted ecosystems, increase public and firefighter safety, and reduce the potential for resource and property loss from wildland fires. The National Fire Plan and various legislation have encouraged treatment of wildland fuels. Recent legislation (including the Healthy Forests Initiative and the Healthy Forests Restoration Act) continues to increase this emphasis. Based on the need, as well as the current emphasis, both mechanical fuels treatments and prescribed burn activities are expected to increase on all ownerships, although to a higher degree on federally managed lands, during this planning period.

Historic, current, and reasonably foreseeable future cumulative impacts related to fire and fuels were considered and analyzed. The following cumulative impacts are discussed in the context of impacts expected over the next 10- to 15-year period. The area of consideration for these cumulative impacts is primarily encompassed within the boundary of the planning area, with FRCC and expected treatments on lands of similar fuel types and directly adjacent to the planning area also taken into consideration. Fire statistics used in estimating fire risk and acres burned by wildfire included the years 1980 through to the present.

Fire Regime Condition Class

Fire-suppression activities have had the effect of increasing FRCC, particularly in ponderosa pine, pinyon/juniper, and warm-dry mixed conifer (Fire Regimes I, II, and IV) vegetation types. The trend under all of the alternatives would be for current condition classes in Fire Regimes I, II, and IV (short to moderate fire-return interval fire regimes) to experience a net increase, while Fire Regimes III and V (long fire-return interval fire regimes) would not experience a noticeable change during this planning period. As a result, Fire Regimes I, II, and IV may continue to experience an increase in the potential for uncharacteristically severe fires during this planning period. This is based on the potential levels of timber harvesting, fuels treatment, and wildfire occurrences probability analysis. The increase in condition class may be slightly less for those alternatives with higher timber harvesting and fuel treatment levels. Thus, the increase may be the smallest under Alternative D, followed by Alternatives B, A, and C, respectively. Due to the treated acres, in comparison to total acres, the increase may be minor on a public lands basis.

Fire Risk

The risk of ignition from lightning would be the same under all of the alternatives. The risk of human-caused ignitions may increase as public use of the lands increases and as development within and adjacent to the planning area increases. Regardless of the alternative, development within the WUI (private lands within and adjacent to the federal lands) is anticipated to continue and would most likely increase. It is anticipated that development of private tracts of land within and around public lands are likely to continue to grow. The anticipated trend toward continued growth in the WUI may increase the values at risk from wildfire and would potentially increase the incidence of human-caused ignitions. Growth of the WUI also creates greater importance for fire prevention and mitigation activities, and increases the complexity and cost of wildland fires that occur in those areas (due to safety considerations for firefighters and residents, as well as to the values at risk). The fire risk and the acreage expected to be burned by wildfires is anticipated to be similar under all of the alternatives.

Air Quality

Generally, the smoke created by individual wildfires or prescribed burns within the planning area does not have a noticeable impact on air quality, unless the fires become large and last for many days. However, there is a potential for cumulative impacts to adversely impact air quality. The emphasis on treating fuels on all land ownerships indicates that fuel treatment (including prescribed burns) would increase in the future. None of the alternatives would result in any impacts on the amount of fuel treatments on adjacent non-federal ownerships; therefore, any prescribed burns implemented or wildfires occurring on adjacent lands may have the potential to cumulatively impact air quality (especially if multiple ownerships conduct prescribed burns during the same time frames). Any federal fire agency that conducts prescribed burning projects within the state of Colorado must comply with CDPHE smoke management regulations (CDPHE 2011). Implementation of burning within the requirements of these regulations would increase the potential to maintain air quality. These smoke management regulations would minimize the chance that air quality would be cumulatively degraded by the implementation of burns conducted by multiple burners at the same time.

It is anticipated that the level of fuels treatments would be similar under all of the alternatives; therefore, the differences between the alternatives with regard to overall cumulative impacts may be minor (indicating that potential cumulative impacts may be almost the same under all of the alternatives).

3.12 Air Quality

3.12.1 Introduction

The primary goal of air quality management is to protect air quality within, and adjacent to, the SJNF and TRFO. The management objectives related to this goal are to:

- Ensure that the air quality within the planning area meets state and federal air quality standards and regulations;
- Protect visibility at Class I areas and at scenic and important vistas; and
- Cooperate directly with the State of Colorado, the EPA, and the NPS, with regard to air quality issues at nearby federal Class I (Clean Air Act) areas.

Under FLPMA and the Clean Air Act, the USFS and BLM cannot conduct or authorize any activity that does not conform to all applicable local, county, state, Native American tribal, and other federal air quality laws, statutes, regulations, standards, and implementation plans. Therefore, an air quality effects analysis based on atmospheric dispersion modeling was conducted to analyze potential air quality impacts.

The planning area includes the Weminuche wilderness Class I area and is adjacent to the Mesa Verde National Park Class I area. Because air quality protection is legally mandated for Class I areas, this air quality impact analysis focuses more detail on the potential air quality changes at Class I areas within the Four Corners region.

In comparison to oil and gas drilling and production, other management actions on the SJNF and TRFO considered throughout this analysis are expected to result in minor and/or short duration impacts to air quality. Potential smoke impacts associated with fuels treatments would be analyzed at the project level. Prescribed burning must comply with all applicable air quality standards and with burn permits issued by the State of Colorado. The modeled impacts in the analysis assess the maximum reasonable scenario for oil and gas development over a 15-year period as characterized in the RFD.

3.12.2 Affected Environment

The SJNF administers the Weminuche wilderness Class I area, located in the San Juan Mountains. The Mesa Verde National Park Class I area is adjacent to the southwest portion of the SJNF and TRFO. The terrain of the SJNF and TRFO is considered complex, with lands to the west dominated by mesas and canyons of the Colorado Plateau and the remaining lands dominated by mountains, foothills, and river valleys of the San Juan Mountains.

Table 3.12.1 summarizes air quality data in southwest Colorado and northwest New Mexico for selected air pollutants. Background data were conservatively selected from the monitoring station with the highest concentrations during the reporting period. Data have been taken from air quality measurement stations in La Plata, Colorado; Ignacio, Colorado; Farmington, New Mexico; and Mesa Verde National Park, Colorado.

Table 3.12.1: Background Air Quality Data

Pollutant (units of measurement)	Measured Ambient Concentrations ($\mu g/m^3$)	Monitoring Station
NO_2 – annual concentration	17	La Plata, CO

Pollutant (units of measurement)	Measured Ambient Concentrations (µg/m³)	Monitoring Station
NO_2 – 1-hr 2nd high concentration	30 (ppb)	Shamrock Mines, CO
SO_2 – annual concentration	5.3	Farmington, NM
SO_2 – 24-hr highest 2nd high concentration	21	Farmington, NM
SO_2 – 3-hr highest 2nd high concentration	69	Farmington, NM
SO_2 – 1-hr highest concentration	12 (ppb)	Portland, CO*
CO – 8-hr highest 2nd high concentration	1,864	Ignacio, CO
CO – 1-hr highest 2nd high concentration	2,330	Ignacio, CO
PM_{10} – annual concentration	21	La Plata, CO
PM_{10} – 24-hr highest 2nd high concentration	64	La Plata, CO
$PM_{2.5}$ – annual concentration	6.9	Farmington, NM
$PM_{2.5}$ – 24-hr highest 2nd high concentration	22.5	Mesa Verde NP, CO
O_3 – 8-hr highest 2nd concentration	142	Mesa Verde NP, CO

* There are no SO_2 monitors in southwest Colorado; the CDPHE recommends and provided data from Portland, CO.
NO_2 = nitrogen dioxide
SO_2 = sulfur dioxide
CO = carbon monoxide
PM_{10} = particulate matter smaller than 10 microns in diameter
$PM_{2.5 =}$ particulate matter smaller than 2.5 microns in diameter
O_3 = ozone
µg/m³ = microsiemens per cubic meter
ppb = parts per billion

Ambient air measurements for existing air quality in the project area are in compliance with NAAQS. Concentrations for most air pollutants are well below the applicable state and federal ambient air quality standards. One exception would be for ozone, where the existing air quality concentrations are approaching the ambient 8-hour air quality standard of 150 µg/m³ (75 parts per billion [ppb] measured as the annual fourth highest daily maximum 8-hour concentration, averaged over 3 years). Ozone is not emitted directly from sources, but instead is formed through photochemical conversions in the atmosphere from other precursor pollutants, primarily volatile organic compounds (VOCs) and nitrogen oxides (NO_x).

The SJNF and TRFO operate Shamrock Station, a reference nitrogen dioxide (NO_2) and ozone monitoring station northeast of Bayfield, Colorado. The data from this station are summarized in Table 3.12.2 and show low 1-hour NO_2 concentrations in southwest Colorado compared to the NAAQS of 100 ppb.

Table 3.12.2: Five Highest Daily 1-hour Average Nitrogen Dioxide Measurements in 2009 to 2011 at Shamrock Station near Bayfield, Colorado

Value Rank	Date	Daily Maximum 1-Hour Average (ppb)
1	1/5/2009	31.0
2	1/6/2010	30.0
3	12/25/2011	30.0
4	1/14/2011	27.0
5	1/28/2010	26.0

Ozone

The standard for ground-level ozone is an 8-hour average of 75 ppb (3 year average of the fourth highest annual 8-hour average measurement). Ozone in the Four Corners region is elevated as reflected by monitoring stations in the region, but the standard for ozone has not yet been exceeded.

State and federal agencies, as well as industry and the public, are concerned about potential non-attainment. The EPA has also proposed lowering the ozone standard, which could result in the designation of non-attainment areas in the Four Corners region. The SJNF and TRFO operate a reference ozone monitoring station (Shamrock Station) northeast of Bayfield, Colorado. The data from this station show the elevated ozone levels in southwest Colorado (Table 3.12.3).

Table 3.12.3: Five Highest 8-hour Average Ozone Measurements in 2011 Shamrock Station near Bayfield, Colorado

Value Rank	Date	Daily Maximum 8-Hour Average (ppb)
1	6/21/2011	82
2	7/1/2011	79
3	6/14/2011	78
4	6/9/2011	77
5	5/7/2011	76

Regional air quality modeling was conducted by the States of New Mexico and Colorado in 2009 (New Mexico Environment Department 2010). The Air Quality Modeling Study for the Four Corners Area assessed ozone impacts to Mesa Verde National Park and other areas in the Four Corners Region. Mesa Verde and Weminuche wilderness Class I areas, as well as the SJNF and TRFO, are located within the high resolution 4-kilometer (km) modeling domain used in the study.

Ground-level ozone is a pollutant resulting from complex chemical reactions between NO_x and VOCs in the presence of heat and sunlight. Models that predict the formation and transport of ozone use NO_x and VOC emission inventories because these are the chemical precursors of ozone. NO_x and VOC pollution source information was considered by the SJNF and TRFO in the development of mitigation measures that would be most beneficial to reducing ozone.

For the Air Quality Modeling Study for the Four Corners Area (New Mexico Environment Department 2010), a photochemical model (Comprehensive Air Quality Model with Extensions [CAM_x]) was run to predict ozone formation. The oil and gas industry accounts for about 31% of the human-caused NO_x in 2005 within the Four Corners Region 4-km domain (Figure 3.12.1). By 2018, about 37% of the human-caused NO_x could be attributable to the oil and gas industry.

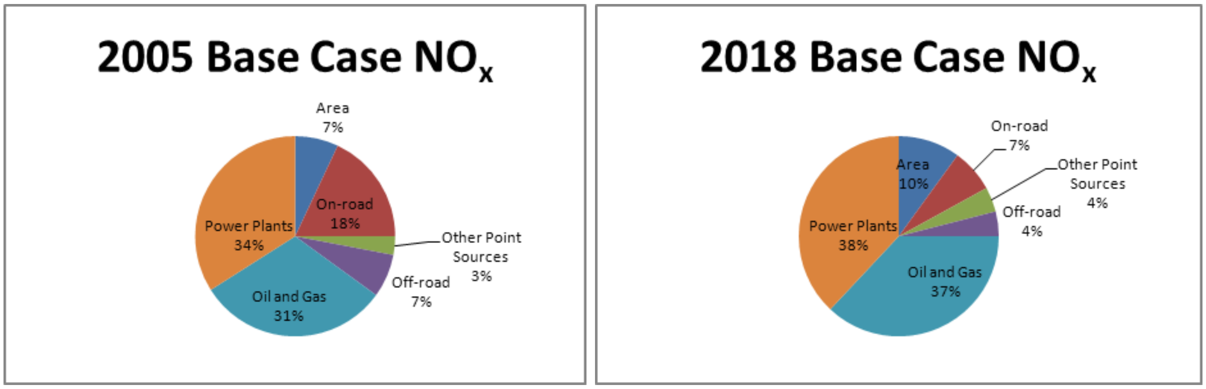


Figure 3.12.1: Human-caused Nitrogen Oxide Emissions within the Four Corners Region (4-km domain) (Source: Colorado Department of Public Health and Environment [2011] and New Mexico Environment Department [2009])

The model emission inventories show that VOC pollution could increase by about 11% from 2005 to 2018 (Figure 3.12.2). This is due in large part to the continued build-out of the oil and gas sector in the Four Corners region. Oil and gas accounts for 64% VOCs of emissions in 2005 and 70% VOCs of predicted emissions in 2018.

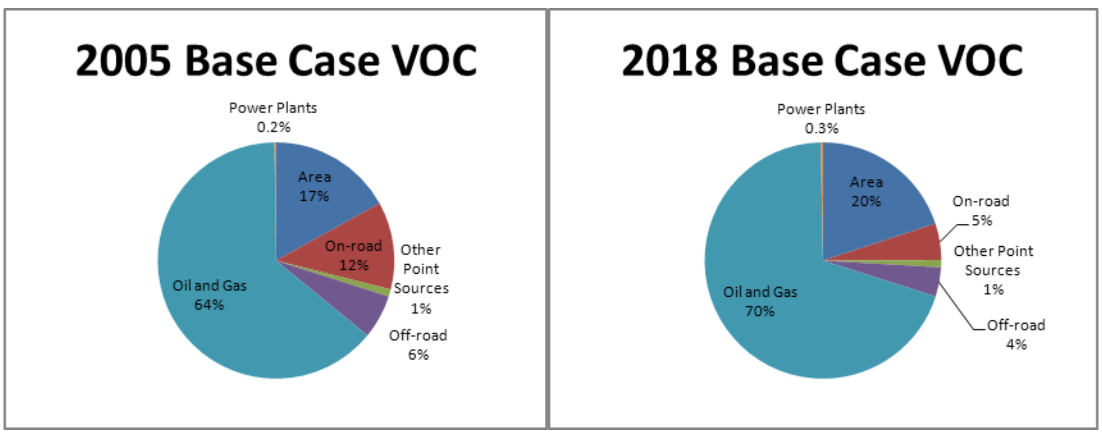


Figure 3.12.2: Human-caused Volatile Organic Compound Emissions within the Four Corners Region (4-km domain) (Source: Colorado Department of Public Health and Environment [2011] and New Mexico Environment Department [2009])

The Air Quality Modeling Study for the Four Corners Area (New Mexico Environment Department 2010) provides detailed information about major pollution sources affecting the formation of ozone at the Mesa Verde Class I area. The largest pollution source contributing to 1-hour average ozone concentrations during July at Mesa Verde come from long-range sources outside the region and outside the 4-km boundary. When considering only local pollution sources within the 4-km domain, oil and gas operations in New Mexico and Colorado are the largest local contributors to ozone on high concentration days over 70 ppb. Other large contributors include electric generating utilities (coal plants) and biogenics (natural sources such as trees and other vegetation).

Atmospheric Deposition

Elevated levels of sulfur and nitrogen oxides are of significant concern because they can lead to the acidification of precipitation and surface waters. These chemicals can cause significant changes in wilderness ecosystems. The source of nitrogen in small, high-elevation lakes in the Weminuche

wilderness is largely atmospheric. Atmospheric (wet) deposition monitoring at Molas Pass shows that since the 1990s there has been a significant increasing trend in nitrate (NO_3) concentrations. There is also a corresponding significant decreasing trend of sulfate (SO_4) concentration in precipitation (National Atmospheric Deposition Program 2011).

The USFS has been sampling the water chemistry of lakes to monitor atmospheric deposition over the last decade. Dilute water in the most sensitive lakes in the Weminuche wilderness should be very limited in nutrients and other chemicals, but data suggest they are becoming seasonally saturated with nitrogen (Musselman and Slausen 2002).

Elevated deposition of sulfur and nitrogen species are also of concern because they can lead to changes in terrestrial ecosystems. The NPS has expressed a concern that nitrogen deposition near a threshold of 3.0 kilograms/hectare-year (kg/ha-yr) may increase biomass production and therefore create an exponential increase in fire risk at Mesa Verde National Park (NPS 2010). The NPS also expressed a concern that increased nitrogen deposition may change native species composition in favor of non-native species. Table 3.12.4 summarizes the background deposition estimates for Mesa Verde National Park, which are assumed to be representative of the project area as a whole.

Table 3.12.4: Background deposition data, Mesa Verde National Park

Air Quality Related Value	Background Deposition
Nitrogen deposition (kg/ha-yr)	2.3
Sulfur deposition (kg/ha-yr)	1.2

The deposition of mercury is another concern on the SJNF and TRFO. The SJNF and TRFO have been monitoring wet mercury deposition and cooperating with the EPA to monitor reactive gaseous mercury deposition at Molas Pass since 2009. The monitors show that about 24% of total mercury deposition is reactive gaseous mercury, and the remainder is wet (precipitation) deposition (EPA 2011). Mercury deposition at both Molas Pass and nearby Mesa Verde National Park is high compared to other sites in the nation (National Atmospheric Deposition Program 2011).

Atmospheric deposition of mercury often accumulates in terrestrial and aquatic ecosystems. Lakes on and adjacent to the SJNF and TRFO are impacted by elevated mercury deposition. McPhee Reservoir and nearby Narraguinnep, Puett, and Totten Reservoirs, as well as Vallecito Reservoir adjacent to the Weminuche wilderness, have fish consumption advisories because of mercury contamination (CDPHE 2006). Total maximum daily loads have been developed by the State of Colorado to address water mercury contamination issues in McPhee and Narraguinnep Reservoirs (CDPHE 2003). Mercury in the atmosphere, and subsequent deposition in the aquatic environment, is commonly associated with coal-fired power plants (EPA 2005).

Visibility

Existing visibility measurements from the Interagency Monitoring of Protected Visual Environments (IMPROVE) Monitoring Program are shown in Figure 3.12.3 and Figure 3.12.4. Higher values of extinction infer poorer visibility. Data are shown for six Class I areas within or near the SJNF and TRFO where IMPROVE measurements have been collected: Mesa Verde National Park (MEVE1), Bandelier National Monument (BAND1), Canyonlands National Park (CANY1), San Pedro Parks wilderness (SAPE1), Weminuche wilderness (WEMI1), and White River National Forest (WHRI1). The data in Figure 3.12.3 and Figure 3.12.4 represent visibility conditions at each area over the period 2000 through 2006, 7 years total.

Visibility impacts are generally assessed in terms of “natural background” or the expected visibility in the absence of human emission sources. The federal land managers responsible for Class I areas have developed best natural condition visibility estimates for Class I areas in a report called FLAG (Federal Land Managers' Air Quality Related Values Work Group) (USFS et al. 2010). The FLAG report suggests natural visual range is between 169 and 175 miles for the Weminuche wilderness, and between 164 and 175 miles at Mesa Verde National Park. Using the data provided in Figure 3.12.4, and assuming the natural background visibility (extinction) is typically 16 to 18 inverse megameters (Mm-1), Mesa Verde National Park visibility is degraded by approximately 120% compared to natural background visibility for the 20% worst visibility days.

Figure 3.12.3 and Figure 3.12.4 also show the chemical constituents that cause visibility impairment. The biggest difference between monitoring sites appears to be the organic mass by carbon (OMC) component. Organic carbon is often an indicator of fire emissions. Those sites with poorest visibility (Mesa Verde and Bandelier) appear to have been impacted by more fire emissions compared to other sites in the region.

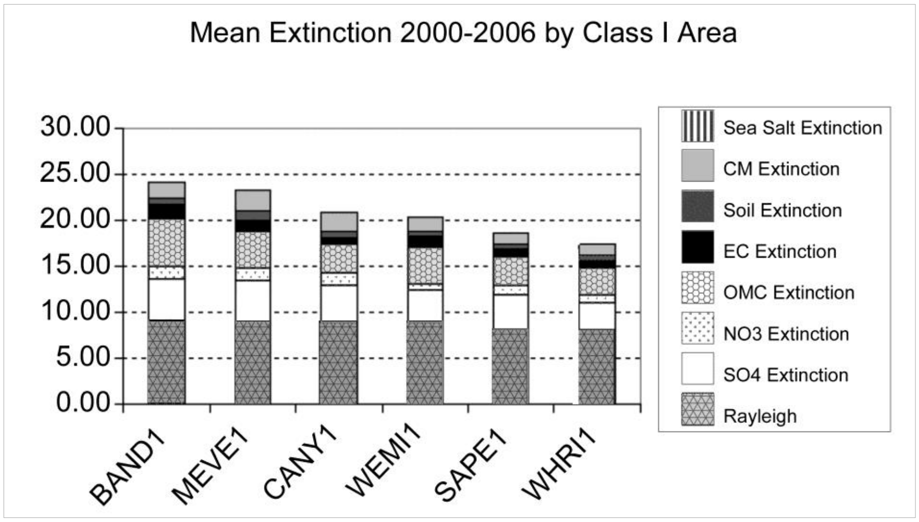


Figure 3.12.3: Mean Extinction by Class I Area, 2000–2006 (the Unit of Measurement for Visibility Extinction is Mm^{-1}; Extinction Sources are Sea Salt, Coarse Material, Soil, Elemental Carbon, Organic Mass by Carbon [source typically fire], NO_3, and SO_4, and Rayleigh)

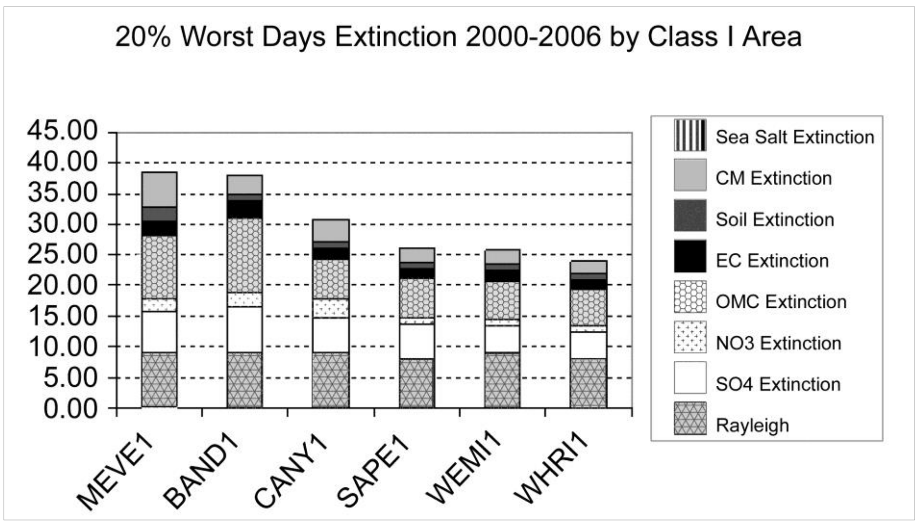


Figure 3.12.4: Twenty Percent Worst Days Extinction by Class I Area, 2000–2006 (the Unit of Measurement for Visibility Extinction in Mm^{-1})

The IMPROVE monitored visibility data were used to provide a check of the modeling results used for the air quality impacts analysis. The CALPUFF model returns a total extinction value (in Mm-1), which was compared to the IMPROVE measurements to provide a general assessment of model performance.

3.12.3 Environmental Consequences

Consultation and Cooperation with Other Agencies

The SJNF and TRFO completed this air quality impact analysis in collaboration with other federal and state agencies, convened as a special technical workgroup. The Air Quality Impact Analysis Stakeholders Group members were:

- CDPHE

- EPA Region 8
- NPS
- BLM
- USFS

In addition to the stakeholders mentioned above, the SJNF and TRFO also actively participates in the Four Corners Air Quality Task Force Policy Oversight Group (POG). Through the POG, the SJNF and TRFO cooperated with EPA Regions 8 and 9, the Utah Department of Environmental Quality, the Southern Ute Indian Tribe, the New Mexico Environment Department, the NPS, and the BLM/USFS in New Mexico. These agencies worked cooperatively to develop and adopt many mitigation strategies to reduce air pollution emissions from oil and gas projects in the Four Corners region.

The Air Quality Impact Analysis Stakeholders Group collaborated with the SJNF and TRFO in providing technical input and data. The POG was of great assistance in developing and prioritizing air pollution mitigation options. Specifically, the Air Quality Impact Analysis Stakeholders Group and the POG assisted with the following elements of the air quality effects analysis:

- Cumulative effects area
- Air quality standards, increments, and air quality related value (AQRV) criteria to be included in analysis
- Ozone analysis strategy
- Class I and sensitive Class II areas included in analysis
- Emission inventory (also provided by Southern Ute Indian Tribe and Navajo Nation)
- Model selection
- Modeling protocol
- Technical review
- Analysis assumptions (e.g., background ammonia concentrations)
- Mitigation measures and other air pollution reduction strategies
- Pre- and post-project monitoring

Air Quality Impact Analysis Methodology

The air quality standards, increments, and AQRV criteria to which potential impacts are compared to are summarized in Table 3.12.5. The air quality thresholds of significance developed by the USFS and NPS were used in determining potential impacts to Class I areas and sensitive Class II areas. This is because the USFS and NPS manage all of the Class I and most of the sensitive Class II areas within the modeling domain. The one exception, Canyons of the Ancients National Monument, is managed by the BLM. It should be noted the BLM uses different thresholds of significance than the USFS and NPS. For example, the visibility thresholds of significance are less stringent for the BLM, being one deciview of change for direct, indirect, and cumulative impacts.

Table 3.12.5: Air Quality Standards, Increments, and Air Quality Related Value Criteria

Pollutant/AQRV	Averaging Interval	NAAQS	Class II PSD Increment (µg/m³)	Class I PSD Increment (µg/m³)	AQRV Thresholds (incremental /cumulative)
NO_2	1-hour[a] Annual	100 ppb 53 ppb	– 25	– 2.5	– –
SO_2	1-hour 3-hour[b] 24-hour Annual	75 ppb 0.5 ppm – –	-- 512 91 20	-- 25 5 2	– – – –
PM_{10}	24-hour	150 µg/m³	30	10	–
$PM_{2.5}$	24-hour[a] Annual	35 µg/m³ 12 µg/m³	– –	– –	– –
CO	1-hour 8-hour	35 ppm 9 ppm	– –	– –	– –
O_3[c]	8-hour	0.075 ppm	–	–	–
Pb	Quarterly	1.5 µg/m³	–	–	–
Visibility (% change)[d]	24-hour	–	–	–	5%/10%
Nitrogen disposition (kg/ha-yr)[e]	Annual	–	–	–	0.005/3.0[f]
Sulfur deposition (kg/ha-yr)[e]	Annual	–	–	–	0.005/3.0[g]

[a] 98th percentile, averaged over 3 years.
[b] The State of Colorado has also established a 3-hour SO_2 ambient air quality standard of 700 µg/m³, as well as a program similar to the federal Prevention of Significant Deterioration (PSD) increments limiting additional amounts of SO_2 above baseline conditions.
[c] Annual fourth highest daily maximum 8-hourr concentration, averaged over 3 years.
[d] A change in extinction of 10% or greater is believed to be perceptible to most observers. When the change in extinction is 5% or greater, a source is believed to be contributing to any existing visibility impairment. The change in extinction is measured in comparison to "natural" background visibility conditions that are not impaired by existing emissions.
[e] The USFS has established cumulative deposition impacts thresholds of concern.
[f] The NPS uses various nitrogen critical loads to assess cumulative deposition impacts.
[g] The NPS has not yet developed sulfur critical loads to assess cumulative deposition impacts.

Far-field Impacts (Class I)

Potential air quality impacts were analyzed to determine the maximum "far-field" effects on ambient air pollutant concentrations, visibility, and atmospheric deposition of sulfur and nitrogen. Far-field impacts were assessed using three different types of receptors across the modeling domain; Class I areas, Class II sensitive receptors, and spatial grid receptors. Because the specific locations of wells are not known at this time, it was assumed that the wells would be spaced somewhat equidistantly across a grid and the well emissions were modeled as area sources, not as point sources.

Near-field Impacts (Class II)

Near-field modeling, specifically ozone analysis, would be completed in the future when projects are submitted with some site-specificity. Near-field and ozone modeling were not completed for this analysis for the following reasons:

- This is not a project-level analysis but a planning analysis of a decision whether to lease federal lands for minerals development.
- The GSGP area is a new, speculative, and unproven gas play.
- The locations of wells are unknown at this time. The site specificity needed for near-field modeling and ozone analysis are not available.

The USFS and BLM have consulted with the Air Quality Impact Analysis Stakeholders Group (see above section Consultation and Cooperation with Other Agencies in Section 3.12.3, above) regarding the ozone analysis conducted for the LRMP. It was agreed among the group that ozone modeling would not occur at this LRMP/lease availability phase of NEPA analysis. Ozone analysis would occur when more site-specific NEPA can be conducted at the project development NEPA analysis stage when development can be adequately defined in terms of geographic areas, drilling methods, well and road locations, well density, well drilling rates, and production rates. The strategy for ozone analysis and monitoring is as follows:

1) The USFS and BLM would purchase and deploy a continuous ozone monitoring station to evaluate actual ozone concentrations downwind of the Paradox Basin in cooperation with the CDPHE. This station would provide, at a minimum, 3 years of data (EPA reference quality). This ozone monitoring station was purchased and deployed during the summer of 2010 at a site cooperatively selected by the CDPHE, BLM, and USFS now located in Norwood, Colorado.

2) The SJNF and TRFO would commit to the long-term operation of the air monitoring station at Shamrock Mines. Both agencies would continue to monitor ozone, NO_x, NO_2, meteorology, and aerosols.

3) The BLM and USFS have authority to apply resource-protective standards, guidelines, stipulations, and other mitigation measures on new leases. The agencies may also condition the approval of permits on existing leases if resource conditions warrant (per BLM IM CO-2010-028 [BLM 2010c]). The LRMP includes standards and guidelines to protect air quality and would identify the lease stipulations and permit COAs for new oil and gas development. Specific mitigation measures that would limit the release of ozone precursors are discussed below."

4) Ozone modeling would be implemented when 210 wells have been permitted in the GSGP area or when project-level or field development NEPA analysis is conducted, whichever occurs first. Two-hundred ten wells are about 10% of the overall projected number of wells to be drilled over the next 15 years in the Paradox Basin. The 210-well threshold includes all wells permitted by the COGCC and the SJNF and TRFO beginning in the year 2008 on all mineral estates, not just federal mineral estate. Once the 210-well threshold is reached, there will be better information about the play area, including drilling data to verify the RFD development projections and the economic viability of the play. Furthermore, whether triggered by the 210-well threshold or project proposal for GSGP development (i.e., project NEPA analysis stage), there would be more project-specific details (such as number of wells, well and road locations, the methodologies for transporting water and drilling materials to and from the well sites, etc.) that can be used for ozone modeling and impacts analysis than is available at this time. The SJNF and TRFO would work

closely with the operators and the COGCC to track the number of gas shale well permits, the success rates, and developable acreage.

Air Quality Analysis Technical Support Document

Detailed information regarding atmospheric dispersion model setup, emission inventories, and model results, can be found in the Air Quality Analysis Technical Support Document (TSD) for the SJNF and TRFO (Air Resource Specialists 2009). It should be noted that the TSD refers to Scenario 1 and Scenario 2. Scenario 2 is the No Leasing Alternative and includes all wells that could be drilled under current leases. Scenario 1 includes only the wells associated with additional leasing of the maximum amount of federal minerals considered in the RFD document. The potential air quality impacts from the RFD scenario displayed in this FEIS are the summation of modeled emissions from Scenario 1 plus Scenario 2. The RFD scenario visibility impacts were modeled using the emission inventories from Scenario 1 plus Scenario 2.

Atmospheric Dispersion Model Setup

Atmospheric dispersion models, including the one used for this FEIS, are computer programs designed to simulate how pollutants in the atmosphere disperse, and in some cases, how they react in the atmosphere. The dispersion models are used to estimate the downwind concentration of air pollutants that can impact ambient air quality.

The Air Quality Impact Analysis Stakeholders Group worked with the SJNF and TRFO to determine the appropriate dispersion model and modeling protocol to be used for this analysis. CALPUFF is the EPA-approved model that was selected and agreed upon by all stakeholders. CALPUFF is a non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal. CALPUFF can be applied for long-range transport and for complex terrain. The air quality analysis, modeling protocols, and emission inventory development are described in detail in the Air Quality Analysis TSD.

All dispersion models, regardless of their level of complexity, are mathematical approximations of the behavior of the atmosphere. The results need to be appropriately viewed as estimates of possible future concentrations and not as exact predictions in time and space. The dispersion modeling uses the best available information and methods (EPA-approved models, emission factors, etc.) when possible, combined with the best scientific and professional judgment in an attempt to ensure that projections of future air quality are neither under-predicted nor unrealistically over-predicted.

CALPUFF was used to evaluate both direct project and cumulative Class I increment impacts and deposition AQRV analyses at nine Class I areas in Colorado, New Mexico, Arizona, and Utah (Figure 3.12.5). The Class I areas and sensitive Class II receptors included in the modeling domain were selected cooperatively by the state and federal agencies of the Air Quality Impact Analysis Stakeholders Group.

The Class I areas within the modeling domain are:

- Weminuche wilderness
- Mesa Verde National Park
- Arches National Park
- Bandelier National Park
- Black Canyon of the Gunnison
- Canyonlands National Park
- La Garita wilderness
- San Pedro Parks wilderness
- West Elk wilderness

Sensitive Class II receptors, national parks, and State of Colorado scenic vistas are:

- Canyon de Chelly National Monument
- Canyons of the Ancients National Monument
- Chaco Culture National Historic Park
- Hovenweep National Monument
- Natural Bridges National Monument
- Lizard Head Pass Overlook
- Chalk Mountain, South San Juan wilderness
- Dolores Canyon Overlook

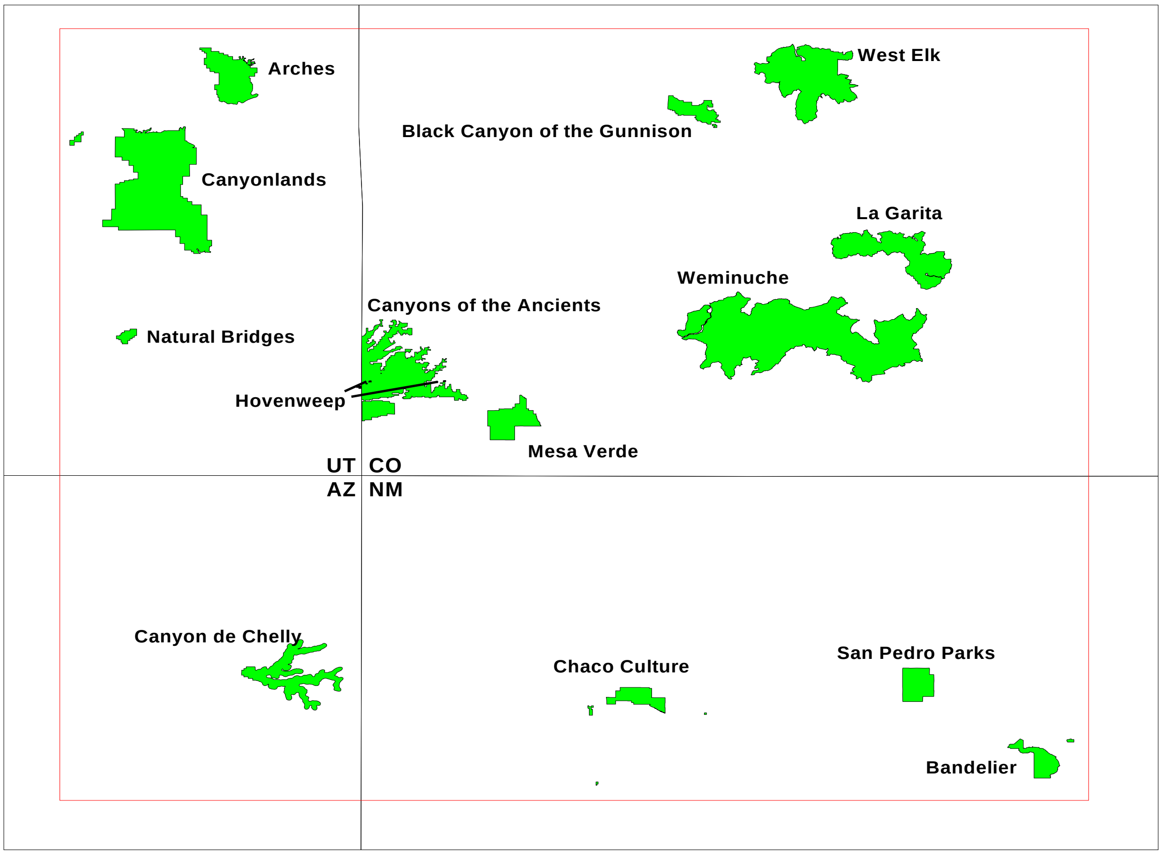


Figure 3.12.5: CALPUFF Modeling Domain, with Class I and Class II Areas to be Evaluated

In addition to the Class I and sensitive Class II areas, the BLM suggested an additional nested fine grid of Class II receptors at 8-km resolution around the project area and a coarse grid of Class II receptors at 24-km resolution over the rest of the domain (Figure 3.12.6).

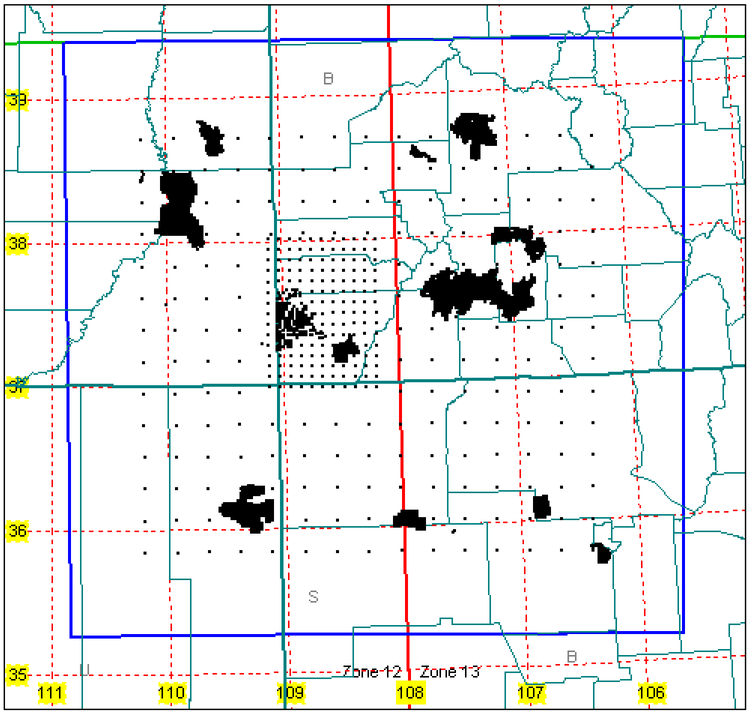


Figure 3.12.6: Fine Grid (8-km) Receptors in the Planning Area, and Coarse Grid (24 km) Receptors over the Rest of the Domain (black areas = Class I and II areas)

Emission Inventories

For this analysis, three air emissions inventories were developed. An emissions inventory was used to model background air quality. It should be noted that this is a standard methodology for many federal and state agencies, but it is not the standard methodology for the BLM. First, the project inventory for the SJNF and TRFO leasing decision included reasonably foreseeable GSGP wells in the Paradox Basin proposed for currently unleased federal minerals. This inventory also included reasonably foreseeable Paradox Basin conventional gas wells proposed for currently unleased federal minerals. The San Juan Sag foreseeable oil development was not included in this emissions inventory because it is assumed a maximum of only two exploration wells might be drilled per year, and none are expected to be productive.

The second inventory was a cumulative oil and gas inventory that considered emissions from existing oil and gas sources and reasonably foreseeable future sources within the study area, summarized as:

- Paradox conventional gas wells on existing federal leases and state and private lands
- Paradox GSGP wells on existing federal leases and state and private lands
- NSJB EIS (USFS and BLM 2006)
- NSJB 80-acre infill wells
- Oil and Gas Development on the Southern Ute Indian Tribe EIS (BLM 2002a)
- Programmatic EA for 80 Acre Infill Oil and Gas Development on the Southern Ute Indian Reservation (BLM and Bureau of Indian Affairs 2009)
- Jicarilla Oil and Gas Leasing EIS (Carson National Forest) (BLM 2012a)

- BLM Farmington Field Office RMP (BLM 2003b)
- Canyons of the Ancients National Monument RMP (BLM 2010a)

The third inventory considered the cumulative inventory for other sources within the modeling domain and includes:

- Existing source emission inventories obtained from the States of New Mexico, Colorado, Utah, Arizona
- Existing source emission inventories for tribal lands in New Mexico, Colorado, Arizona (not including oil and gas sources listed above)
- Proposed Desert Rock Power Plant

Direct, Indirect, and Cumulative Impacts

Actions Common to all Alternatives

If no additional federal lands are offered for lease, some wells in the Paradox Basin (GSGP and conventional Paradox wells) would still be drilled. This is because some USFS and BLM land is already leased, and there are state and private lands that can be developed. Table 3.12.6 summarizes the wells that could be drilled in the Paradox Basin even if no additional federal lands are leased.

Table 3.12.6: Well Numbers for Current Federal Leases and on State and Private Lands

	USFS Leased Lands	BLM Leased Lands	State and Private Lands	Total
Paradox conventional	25 production 10 drilled/reclaimed	125 production 20 drilled/reclaimed	50	230
Paradox/GSGP	105 production 10 drilled/reclaimed	235 production 25 drilled/reclaimed	760	1,135
Total (Paradox conventional and GSGP)				1,365

<u>Reasonably Foreseeable Development</u>

The RFD scenario was modeled to estimate the maximum possible air quality impacts from potential oil and gas development in the Paradox Basin. It was assumed that for Alternatives A through D, the impacts would be equal or less than the RFD scenario. The total number of wells analyzed for the RFD scenario was 2,148 wells. The breakdown of wells that could be drilled in the Paradox Basin on unleased federal lands is displayed in Table 3.12.7. The total 2,148 wells was calculated by adding wells on unleased lands (783 wells) and wells that could be drilled on leased federal lands, plus state and private lands (1,365 wells).

Table 3.12.7: Well Numbers for Maximum Potential Development (Reasonably Foreseeable Development) on Currently Unleased Lands

	Productive Wells	Unproductive Wells	Total
Paradox conventional	120	28 drilled/reclaimed	148
Paradox/GSGP	575	60 drilled/reclaimed	635
Total (Paradox conventional and GSGP)			**783**

National Ambient Air Quality Standards

The CALPUFF model was used to estimate impacts of the regulated air pollutants NO_2, SO_2, PM_{10}, and particulate matter with diameter less than 2.5 microns ($PM_{2.5}$).

Nitrogen Dioxide: All oxides of nitrogen (NO_x) emissions were conservatively assumed to be in the form of NO_2, which is the regulated Clean Air Act pollutant. The incremental impacts to NO_2 concentrations associated with well development in the Paradox basin on already leased lands, currently unleased lands, and for the RFD scenario are displayed in Table 3.12.8.

Table 3.12.8: Incremental Impacts to NO_2 Concentrations from Leased and Unleased Lands in the Paradox Basin

NO_2	Wells on Currently Leased, State, and Private Lands (1,365 wells)	Wells on Currently Unleased Federal Lands (783 wells)	RFD Scenario (2,148 wells)
Maximum direct annual impact (year)	2.18 µg/m³ (2003)	1.45 µg/m³ (2002)	3.63 µg/m³ (2003) (estimate)
Location of max annual impact (latitude, longitude)	Fine grid (37.20817702, 108.8426431)	Fine grid (37.64718859, 108.5549065)	Fine grid Northwest Montezuma County
Maximum direct 1-hour impact	19.46 µg/m³ (2003)	2.81 µg/m³ (2003)	22.28 µg/m³ (2003) (estimate)
Location of max 1-hour impact	Mesa Verde National Park	Mesa Verde National Park	Mesa Verde National Park

The summary model results of the RFD scenario compared to NAAQS and Prevention of Significant Deterioration (PSD) increments are displayed in Table 3.12.9. Detailed model results for all Class I and Class II area receptors can be found in the Air Quality Analysis TSD (Air Resource Specialists 2009). The modeling demonstrated that the oil and gas development direct and indirect impacts of the RFD scenario are well below the NO_2 NAAQS for any Class I or Class II receptor in the modeling domain.

Table 3.12.9: Comparison of Maximum Predicted NO_2 Impacts Compared to National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments

NO_2	RFD Scenario Direct/Indirect	RFD Scenario Cumulative
NAAQS 1-hour	192 µg/m³ (100 ppb)	192 µg/m³ (100 ppb)
NAAQS annual	100 µg/m³ (53 ppb)	100 µg/m³ (53 ppb)
PSD Class I annual	2.5 µg/m³	2.5 µg/m³
PSD Class II annual	25 µg/m³	25 µg/m³
Max annual impact Class I areas	0.6 µg/m³ Mesa Verde National Park	4.285 µg/m³ Mesa Verde National Park
Max annual impact Class II areas	3.63 µg/m³ (estimate) Fine Grid NW Montezuma County	62.6 µg/m³ Near Four Corners Power Plant, New Mexico
Max 1-hour impact Class I areas	22.3 µg/m³ (estimate) Mesa Verde National Park	157 µg/m³ Mesa Verde National Park
Max 1-hour impact Class II areas	19.1 µg/m³ Canyons of the Ancients National	326 µg/m³ Chaco Culture National Historic Park

NO_2	RFD Scenario Direct/Indirect	RFD Scenario Cumulative
	Monument	

The modeled cumulative impacts to 1-hour concentrations of 326.00 µg/m³ at Chaco Culture National Historic Park are potentially higher than the 1-hour NO_2 NAAQS (192 µg/m³). These future projections of cumulative impacts do not signify an actual violation. Rather they show that cumulative impacts from existing sources may pose a problem and need to be carefully examined by the regulatory agencies prior to issuing permits for new construction in the area. The high NO_2 results at Chaco Culture National Historic Park are likely related to oil and gas and power plant pollution sources in New Mexico since the NO_2 1-hour concentrations are much lower at all receptors near the Paradox Basin well field. The SJNF and TRFO would adopt many mitigation measures that would significantly reduce predicted NO_x emissions from oil and gas production and development activities on the SJNF and TRFO. This should significantly reduce the direct and indirect impacts to air quality from the RFD scenario.

The informal PSD information presented in Table 3.12.9 above is provided at the request of the EPA who was a stakeholder in the SJNF and TRFO air quality impact analysis. Its usefulness is to better understand potential project impacts to Class I areas. Most oil and gas emission sources are not considered PSD major sources under the Clean Air Act, and therefore the comparison is not a formal PSD increment analysis, nor is it intended to replace such an analysis. The BLM and USFS do not have the authority to conduct regulatory PSD increment analysis.

The direct project impacts of the RFD scenario would not exceed the NO_2 Class I PSD increment (2.5 µg/m³) or the Class II PSD Increment (µg/m³). The cumulative impacts to Class I PSD increment for NO_2 would be exceeded at Mesa Verde National Park at 4.285 µg/m³. Cumulative visibility impacts to Class I areas have long been recognized and are widely understood to be a problem across the country. This was the primary reason Congress promulgated the Regional Haze Rule.

The model results show that cumulative impacts to the annual Class II PSD increment (25 µg/m³) would be exceeded within the coarse grid of the modeling domain with a maximum annual NO_2 concentration of 62.6 µg/m³. This location is less than 4.7 miles from the Four Corners Power Plant. This power plant emits over 49,000 tons per year of NO_x and is less than 8.5 miles from the San Juan Generating Station, which emits over 40,000 tons per year of NO_x. These are likely the significant contributing sources to the high localized NO_2 concentration. In addition, numerous existing oil and gas wells are in this part of New Mexico, and additional NO_2 sources are anticipated in this area in conjunction with the BLM Farmington Field Office RMP RFD (Engler et al. 2001).

The air quality impacts from Alternatives A, B, C, and D would be the same or lower compared to the RFD scenario for NO_2 impacts. All of the alternatives propose fewer wells compared to the RFD scenario and, therefore, would emit lower NOx emissions.

Sulfur Dioxide: The incremental impacts to SO_2 concentrations associated with well development in the Paradox Basin on already leased lands, currently unleased lands, and for the RFD scenario are displayed in Table 3.12.10. Detailed model results for all Class I and Class II area receptors can be found in the Air Quality Analysis TSD (Air Resource Specialists 2009). The direct contributions of the RFD scenario to SO_2 concentrations at all receptors within the modeling domain are insignificant due to the low level of project-related SO_2 emissions. Project SO_2 emissions would be generated primarily by the short-term use of diesel engines needed to drill and complete new wells.

Table 3.12.10: Incremental Impacts to SO_2 Concentrations from Leased and Unleased Lands in the Paradox Basin

SO_2	Currently Leased, State, and Private Lands (1,365 new wells)	Currently Unleased Federal Lands (783 new wells)	RFD Scenario (2,148 wells)
Maximum direct annual impact (meteorological year)	0.157 µg/m³ (2003)	0.15 µg/m³ (2002)	0.313 µg/m³ (2003) (estimate)
Maximum direct 24-hour impact (meteorological year)	0.38 µg/m³ (2003)	0.368 µg/m³ (2003)	0.748 µg/m³ (2003) (estimate)
Maximum direct 3-hour impact (meteorological year)	1.12 µg/m³ (2003)	0.970 µg/m³ (2003)	2.09 µg/m³ (2003) (estimate)
Maximum direct 1-hour impact (meteorological year)	0.84 µg/m³ (2003)	0.34 µg/m³ (2003)	1.18 µg/m³ (2003) (estimate)
Location of max annual impact* (latitude, longitude)	(37.2070686, 108.750069)	(37.64718859, 108.5549065)	Approx center of project area
Location of max 24-hour impact* (latitude, longitude)	(37.2070686, 108.750069)	(37.20459604, 108.5649312	About 12 miles north of Mesa Verde
Location of max 3-hour impact* (latitude, longitude)	(37.2070686, 108.750069)	(37.64718859, 108.5549065)	Approx center of project area
Location of max 1-hour impact*	Mesa Verde National Park	Mesa Verde National Park	Mesa Verde National Park
*All maximum annual, 24-hour, and 3-hour concentrations occur within the fine grid receptors of the modeling domain.			

Table 3.12.11 below demonstrates that the direct contributions of the RFD scenario produce very small concentrations of SO_2 for all averaging times and for all receptors in the modeling domain. The direct and indirect oil and gas development associated with the RFD scenario do not exceed any of the SO_2 NAAQS.

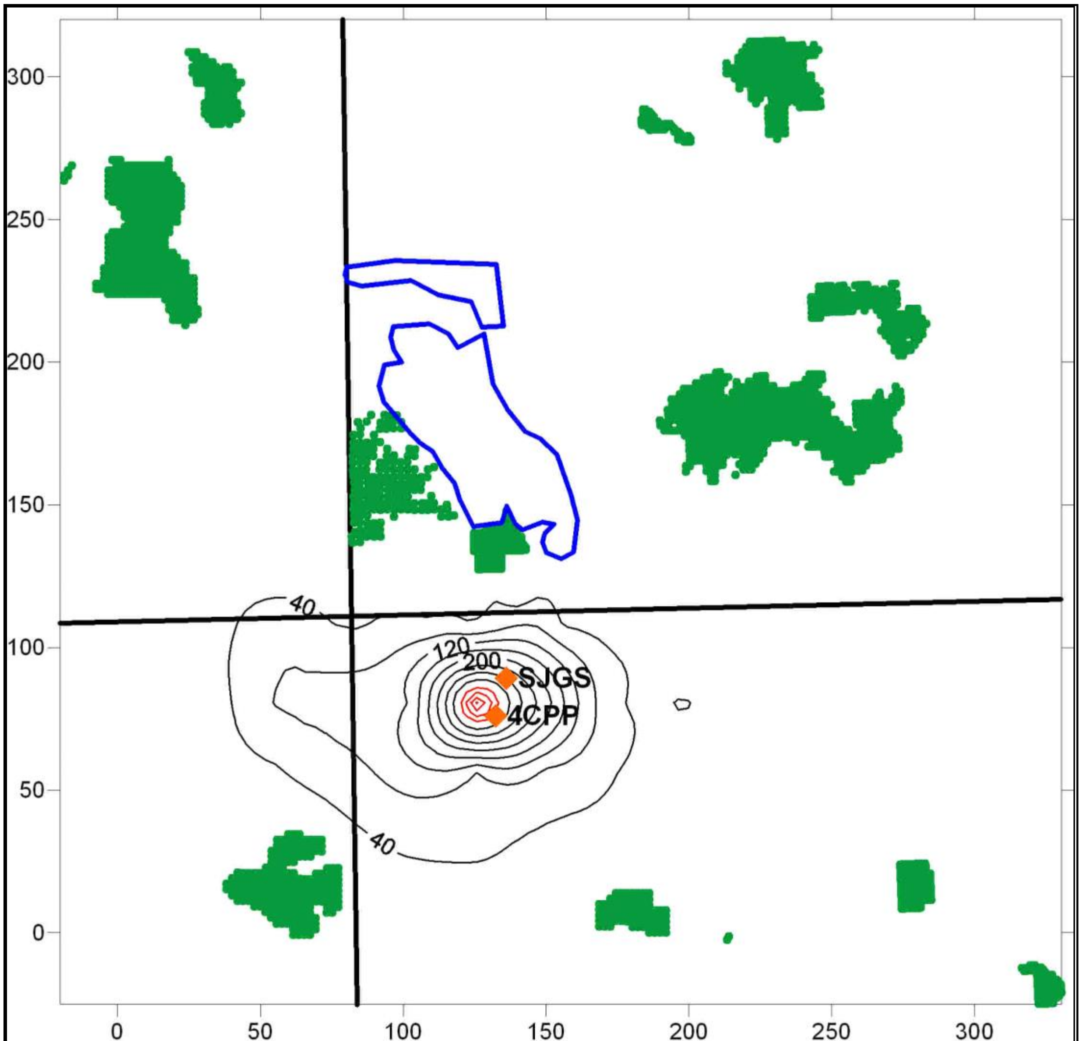
Cumulatively, the modeled 1-hour SO_2 concentrations at Mesa Verde National Park could be higher than the 1-hour SO_2 NAAQS. The location of the coarse grid high SO_2 impacts is in the same spot as the high concentrations of coarse grid NO_x and PM_{10}, near the Four Corners Power Plant, which emits over 27,000 tons per year of SO_2, and near the San Juan Generating Station, which emits over 32,000 tons per year of SO_2 (see Figure 3.12.7, below, for a map showing high concentration areas). It is important to note that the GSGP and Paradox conventional projects would not emit appreciable SO_2; therefore, the modeled maximum concentrations for SO_2 are wholly due to existing sources and other reasonable foreseeable projects and not due to the projects under review for this FEIS.

Table 3.12.11: Comparison of Maximum Predicted SO_2 Impacts Compared to National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments

SO_2		RFD Scenario	RFD Scenario Cumulative
NAAQS 1-hour		200 µg/m³ (75 ppb)	200 µg/m³ (75 ppb)
NAAQS 3-hour		1300 µg/m³ (0.5 ppm)	1300 µg/m³ (0.5 ppm)
PSD Class I (µg/m³)	3-hour	25	25
	24-hour	5	5
	Annual	2	2
PSD Class II (µg/m³)	3-hour	512	512

SO_2		RFD Scenario	RFD Scenario Cumulative
	24-hour	91	91
	Annual	20	20
Max impact Class I areas (meteorological year)	1-hour	1.18 µg/m³ Mesa Verde National Park (2003)	187 µg/m³ Mesa Verde National Park
	3-hour	0.575 µg/m³ Mesa Verde National Park (2003)	132 µg/m³ Mesa Verde National Park
Max impact Class II areas (meteorological year)	1-hour	0.669 µg/m³ Canyons of the Ancients (2002)	209.45 µg/m³ Canyon DeChelly National Monument
	3-hour	2.09 µg/m³ (2003) Approx. center of project area	2,745 µg/m³ Near Four Corners Power Plant

These cumulative impacts do not signify an actual violation. Rather, they show that cumulative impacts from existing sources may pose a problem and need to be carefully examined by the regulatory agencies prior to issuing permits for new construction in the area. The very high SO_2 results near the New Mexico power plants should be viewed with caution. First, CALPUFF is not the preferred air quality model for receptors in the near-field (within 50 km of the source). Second, for this model analysis, emission sources with similar stack parameters were combined in order to keep the number of sources modeled manageable. Therefore, Four Corners Power Plant and San Juan Generating Station were each modeled as a single stack. Although elevated SO_2 concentrations would be expected in the vicinity of the power plants, the accuracy of CALPUFF for these possible NAAQS violations is less certain. Again, the extremely low project emissions associated with the RFD scenario (24-hour max concentrations 0.748 µg/m³) would not contribute to cumulative high SO_2 concentrations in New Mexico. However, The SJNF and TRFO would adopt many mitigation measures that would reduce sulfur emissions from oil and gas production and development activities on the SJNF and TRFO.



Contours from 40 to 320 micrograms per cubic meter in black, with a contour interval of 40 micrograms per cubic meter.
Contours from 365 to 255 micrograms per cubic meter (above the 24-hour NAAQS for SO2) in red with a contour interval of 30 micrograms per cubic meter.
Cumulative impacts include existing, other RFD, and maximum development sources but no additional background concentration.
Locations of the Four Corners Power Plant (4CPP) and San Juan Generating Station (SJGS) are shown in orange.
Approximate extent of project area is outlined in blue.

Figure 3.12.7: Composite of the Cumulative Highest/Second Highest 24-hour SO_2 Modeled Impacts for 2001–2003, Including the Reasonably Foreseeable Development Scenario Wells

The informal PSD information presented in Table 3.12.11 above is provided at the request of the EPA, who was a stakeholder in the SJNF and TRFO air quality impact analysis. Most oil and gas emission sources are not considered PSD major sources under the Clean Air Act and, therefore, the comparison is not a formal PSD increment analysis, nor is it intended to replace such an analysis. The BLM and USFS do not have the authority to conduct regulatory PSD increment analysis.

The direct project impacts of the RFD scenario are well below any Class I PSD increment for SO_2 and are also well below all Class II PSD increments. This is due to the very low SO_2 emissions associated with the planning area.

The cumulative impacts to Class I PSD increment for SO_2 would be exceeded at Mesa Verde National Park for all SO_2 concentration averaging times. Cumulative visibility impacts to Class I areas have long been recognized and are widely understood to be a problem across the country. This was the primary reason Congress promulgated the Regional Haze Rule.

The cumulative impacts to Class II PSD increments for SO_2 would be exceeded for all SO_2 concentration averaging times within the coarse grid receptors of the modeling domain. Again, the informal PSD information presented in Table 3.12.11 above is provided at the request of the EPA, who was a stakeholder in the SJNF and TRFO air quality impact analysis. The BLM and USFS do not have the authority to conduct regulatory PSD increment analysis.

The air quality impacts from Alternatives A, B, C, and D would be the same or slightly lower compared to the RFD scenario for SO_2 impacts. All of the alternatives propose fewer wells compared to the RFD scenario and, therefore, would emit lower SO_2 emissions.

Particulate Matter (PM_{10} and $PM_{2.5}$): The incremental impacts to PM_{10} and $PM_{2.5}$ concentrations associated with well development in the Paradox Basin on already leased lands, currently unleased lands, and for the RFD scenario are displayed in Table 3.12.12. Detailed model results for all Class I and Class II area receptors can be found in the Air Quality Analysis TSD (Air Resource Specialists 2009).

Table 3.12.12: Incremental Impacts to PM_{10} and $PM_{2.5}$ Concentrations from Leased and Unleased Lands in the Paradox Basin

Particulate Matter	Wells on Currently Leased, State and Private Lands (1,365 wells)	Wells on Currently Unleased Federal Lands (783 wells)	RFD Scenario (2,148 wells)
$PM_{2.5}$			
Maximum direct annual impact (year)	0.334 µg/m³ (2003)	0.374 µg/m³ (2002)	0.704 µg/m³ (2003) (estimate)
Maximum direct 24-hour impact	0.922 µg/m³ (2003)	0.998 µg/m³ (2002)	1.815 µg/m³ (2003) (estimate)
Location of max annual impact (latitude, longitude)	(37.2070686, 108.750069)	(37.64718859, 108.5549065)	About 12 miles north of Mesa Verde
Location of max 24-hour impact (latitude, longitude)	(37.49677787, 108.3722814)	(37.64718859, 108.5549065)	About 19 miles north of Mesa Verde
PM_{10}			
Maximum direct 24-hour impact	2.53 µg/m³ (2003)	2.78 µg/m³ (2002)	5.0 µg/m³ (2003) (estimate)
Location of max 24-hour impact (latitude, longitude)	(37.49677787, 108.3722814)	(37.64718859, 108.5549065)	About 19 miles north of Mesa Verde

The summary model results of the RFD scenario compared to NAAQS and PSD increments are displayed in Table 3.12.13 and Table 3.12.14. The modeling demonstrated that the oil and gas development RFD scenario would not cause exceedance of the PM_{10} and $PM_{2.5}$ NAAQS for any Class I or Class II receptor in the modeling domain.

Table 3.12.13: Comparison of Maximum Predicted $PM_{2.5}$ Impacts Compared to National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments

$PM_{2.5}$	RFD Scenario	RFD Scenario Cumulative
NAAQS annual (µg/m³)	12.0	12.0
NAAQS 24-hour (µg/m³)	35.0	35.0
Max annual impact Class I areas (meteorological year)	0.156 µg/m³ Mesa Verde National Park (2002)	1.092 µg/m³ Mesa Verde National Park
Max annual impact Class II areas (meteorological year)	0.704 µg/m³ About 12 miles north of Mesa Verde (2003)	2.84 µg/m³ Lat 37.19862825, Long 108.1947035 (2003)
Max 24-hour impact Class I areas (meteorological year)	0.465 µg/m³ Mesa Verde National Park (2003)	7.07 µg/m³ Mesa Verde National Park
Max 24-hour impact Class II areas (meteorological year)	1.815 µg/m³ About 19 miles north of Mesa Verde (2003)	15.2 µg/m³ Lat 36.72532681, Long 108.5526668

Table 3.12.14: Comparison of maximum predicted PM_{10} impacts compared to NAAQS and PSD increments

PM10	RFD Scenario	RFD Scenario Cumulative
NAAQS annual (µg/m³)	150	150
NAAQS 24-hour (µg/m³)	10	10
Max annual impact Class I areas (meteorological year)	30	30
Max annual impact Class II areas (meteorological year)	0.429 µg/m³ Mesa Verde National Park (2002)	10.121 µg/m³ Mesa Verde National Park
Max 24-hour impact Class I areas (meteorological year)	2.0 µg/m³ About 12 miles north of Mesa Verde (2002)	27.7 µg/m³ Lat 37.19862825, Long 108.1947035
Max 24-hour impact Class II areas (meteorological year)	1.28 µg/m³ Mesa Verde National Park (2003)	66.977 µg/m³ Mesa Verde National Park
NAAQS annual (µg/m³)	5.0 µg/m³ (estimate) About 19 miles north of Mesa Verde (2003)	130.7 µg/m³ Lat 37.19862825, Long 108.1947035

The direct project impacts of the RFD scenario would not exceed the PM_{10} Class I PSD Increment (10 µg/m³) or the Class II PSD Increment (30 µg/m³). The cumulative impacts to Class I PSD increment for PM_{10} would be exceeded at Mesa Verde National Park at 10.121µg/m³. The model results show that cumulative impacts to annual Class II PSD increment would not be exceeded within the modeling domain. The informal PSD information presented in Table 3.12.14 above is provided at the request of the EPA, who was a stakeholder in the SJNF and TRFO air quality impact analysis. The BLM and USFS do not have the authority to conduct regulatory PSD increment analysis.

The air quality impacts from Alternatives A, B, C, and D would be the same or lower compared to the RFD scenario for particulate matter impacts. All of the alternatives propose fewer wells, fewer well pads, and less construction compared to the RFD scenario and, therefore, would emit lower particulate matter emissions.

Deposition: The modeling also considered the impacts of nitrogen and sulfur deposition compared to AQRV thresholds of significance for NPS and USFS Class I areas. For the direct impacts of the RFD scenario, the NPS deposition analysis threshold of 0.005 kg/ha-yr for nitrogen and sulfur for Class I areas was used to assess significant impacts. With the exception of Mesa Verde, the predicted

nitrogen and sulfur deposition was below the deposition analysis threshold at all Class I and Class II receptors.

Mesa Verde maximum nitrogen deposition was 0.1156 kg/ha-yr, and maximum sulfur deposition was 0.026 kg/ha-yr. Mesa Verde National Park is adjacent to the proposed development areas in the Paradox Basin. Because the NPS deposition analysis threshold was exceeded for nitrogen and sulfur deposition at Mesa Verde National Park, additional analysis and agency consultation was conducted. In addition to the general concern about the regional trend of increasing nitrogen deposition, the NPS has expressed concern about the potential indirect impacts of increased fire risk from increased biomass production as a result of nitrogen fertilization. The other concern was potential species composition shifts from native to non-native vegetation as a result of nitrogen deposition (NPS 2010). The SJNF and TRFO would adopt many mitigation measures that would significantly reduce NO_x and sulfur emissions from oil and gas production and development activities in the planning area. This should result in significant reductions in nitrogen deposition and minor reductions in sulfur deposition, since the unmitigated project emissions of sulfur are very small to begin with.

For cumulative effects analysis, the NPS uses critical loads to determine significance of deposition on herbaceous plants and shrubs. For Mesa Verde National Park, the suggested critical load is 3.0 kg/ha-yr for nitrogen. The critical load for nitrogen has not been exceeded at any Class I areas in the modeling domain. The NPS has not yet determined critical loads for sulfur deposition; however, the USFS threshold of 3.0 kg/ha-yr for sulfur deposition has not been exceeded at any Class I areas in the modeling domain (see Table 3.12.15). Detailed model results for all Class I area receptors can be found in the Air Quality Analysis Technical TSD (Air Resource Specialists 2009).

The air quality impacts from Alternatives A, B, C, and D would be the same or slightly lower compared to the RFD scenario for deposition impacts. All of the alternatives propose fewer wells compared to the RFD scenario and, therefore, would emit fewer nitrogen and sulfur emissions.

Table 3.12.15: Nitrogen and Sulfur Deposition at the Mesa Verde National Park Class I Area from Leased and Unleased Lands in the Paradox Basin

Mesa Verde National Park Nitrogen and Sulfur Deposition	Wells on Currently Leased, State, and Private Lands (1,365 wells)	Wells on Currently Unleased Federal Lands (783 wells)	RFD Scenario (2,148 wells)	Cumulative RFD Scenario
Maximum direct nitrogen deposition impact (year)	0.0928 kg/ha-yr (2002)	0.0229 kg/ha-yr (2003)	0.1156 kg/ha-yr (2003)	1.6 kg/ha-yr (2001)
Maximum direct sulfur deposition impact (year)	0.02 kg/ha-yr (2003)	0.006 kg/ha-yr (2003)	0.026 kg/ha-yr (2003)	1.7 kg/ha-yr (2003)

Acid Neutralizing Capacity of Sensitive Lakes: Deposition of nitrogen and sulfur can cause changes to water chemistry, especially in lakes with very low acid neutralizing capacity (ANC). Several lakes within the Weminuche wilderness Class I area have been determined to be very sensitive to changes in atmospheric deposition. These lakes are relatively close to the Paradox Basin project area. Potential air pollution-caused water chemistry changes were evaluated using the USFS screening methodology for calculating ANC (USFS 2000).

The USFS AQRV threshold for project incremental impacts ANC change is no more than a 10% change from baseline chemistry for those water bodies where the existing ANC is at or above 25

µeq/L and for surface waters that have a baseline of <25 ueq/L ANC, no more than 1 ueq/L decrease in ANC is acceptable (USFS 2012a). No sensitive high mountain lake in the Weminuche wilderness exceeded the ANC threshold when the direct and indirect impacts of the RFD scenario were considered. Changes to ANC from the RFD scenario are displayed in Table 3.12.16.

Table 3.12.16: Percent Change Acid Neutralizing Capacity of High Mountain Lakes in Weminuche Wilderness from Nitrogen and Sulfur Deposition, Reasonably Foreseeable Development Scenario

Mountain Lake	Threshold	ANC Change (%)		
		2001	2002	2003
Big Eldorado Lake (change from baseline ANC)	No more than 1 ueq/L decrease in ANC	0.127 (0.026 µeq/L)	0.148 (0.03 µeq/L)	0.142 (0.029 µeq/L)
Lower Sunlight Lake	< 10% change	0.037	0.043	0.039
Upper Sunlight Lake	< 10% change	0.109	0.128	0.118
Upper Grizzly Lake	< 10% change	0.106	0.124	0.114

Cumulatively, with the exception of Lower Sunlight Lake, ANC for all lakes was higher than the USFS AQRV threshold limit (10% change) for all lakes evaluated. Cumulative changes to ANC from the RFD scenario are displayed in Table 3.12.17. The SJNF and TRFO would adopt many mitigation measures that would reduce nitrogen and sulfur emissions from oil and gas production and development activities on the SJNF and TRFO. This would reduce the impacts to water quality in these sensitive lakes.

Table 3.12.17: Cumulative Percent Change Acid Neutralizing Capacity of High Mountain Lakes in Weminuche Wilderness from Nitrogen and Sulfur Deposition, Reasonably Foreseeable Development Scenario

Mountain Lake	Threshold	ANC Change (%)		
		2001	2002	2003
Big Eldorado Lake	No more than 1 ueq/L decrease in ANC	14.93 (3.04 µeq/L)	16.05 (3.27 µeq/L)	18.57 (3.79 µeq/L)
Lower Sunlight Lake	< 10% change	4.07	4.81	4.51
Upper Sunlight Lake	< 10% change	12.04	14.14	13.38
Upper Grizzly Lake	< 10% change	11.72	13.92	13.06

The air quality impacts from Alternatives A, B, C, and D would be the same or lower compared to the RFD scenario for impacts to ANC. All of the alternatives propose fewer wells compared to the RFD scenario and, therefore, would emit fewer nitrogen and sulfur emissions that affect ANC.

Visibility: Visibility impacts were calculated using two different methods denoted Method 6 and Method 2. The SJNF and TRFO used both visibility assessment methods at the request of the state and federal agencies participating in the Air Quality Impact Analysis Stakeholders Group. Method 6 is the current EPA-approved procedure under the Best Available Retrofit Technology regulations to assess whether a source contributes to existing visibility impairment. Method 2 is the current procedure documented in the Federal Land Managers Air Quality Related Values Workgroup (USFS

et al. 2010) guidance and uses the predicted concentrations of aerosol species from CALPUFF with the daily average relative humidity data to estimate light extinction parameters.

Actual monitored visibility data were used to provide a check of the modeling performance for both methods. The comparison was based on the “existing sources” subset from the model calculations because emissions from projected future activity would not be reflected in the measured visibility data. Also, since the model user is generally interested in the “worst-case” impacts determined by the model for a given emissions scenario, the model versus measurements comparisons are limited to the “average of the 20% worst-case days” as determined from the IMPROVE data, which generally correlate to the 90th percentile measurement. The CALPUFF modeling results are summarized below for those Class I areas in the modeling domain that also have IMPROVE monitors (Table 3.12.18).

Table 3.12.18: CALPUFF Modeling Results* Compared to Class I Areas in the Modeling Domain Having IMPROVE Monitors

Class I Area	IMPROVE Measurement (average of 20% worst-case days, 2000–2006)	CALPUFF Method 2 (mean highest extinction, 2001–2003)	CALPUFF Method 6 (mean 8th highest extinction, 2001–2003)
Bandelier	37	49.9	25.0
Canyonlands	31	65.5	31.1
Mesa Verde	38	77.0	50.3
San Pedro Parks	26	64.4	30.6
Weminuche	26	73.1	30.7
* All values listed above are in units of total extinction (Mm-1)			

In general, Method 2 tends to produce consistently higher visibility impacts compared to Method 6 at the Class I areas modeled for this comparison. The Method 6 results tend to more closely match the measured IMPROVE data at each of the Class I areas. At Bandelier National Monument, the Method 6 model predictions actually under predict the worst-case visibility conditions (based on the 90th percentile measurement). However, Bandelier is toward the eastern edge of the modeling domain, so not all of the sources that contribute to visibility impacts at Bandelier National Monument may have been included in this modeling study. Also, Bandelier shows a relatively high extinction contribution from organic aerosols, which may be an indicator of impacts from local and/or regional wildfires. Wildfire emissions were not modeled in this CALPUFF study.

Otherwise, the CALPUFF model predictions for Method 6 tend to be near or slightly higher than the measured extinction from the IMPROVE program. Since the CALPUFF results for Method 6 in this study correlate better with the IMPROVE measurements, the conclusion is that Method 6 performs better than Method 2 when considering additional impacts analysis for the RFD scenario. Therefore, the visibility analysis relied upon by the SJNF and TRFO would focus on Method 6. Detailed results for both Method 6 and Method 2 can be found in the TSD (Air Resource Specialists 2009).

Three Class I areas had predicted visibility impacts above the 5% change AQRV threshold. Canyonlands National Park was just over at 5.87% on the highest day with 3 days greater than 5% change. Mesa Verde National Park was 9.76% on the highest day and 7.14% on the eighth high day with 29 days greater than 5% change. Weminuche wilderness was also over at 5.85% change on the highest day and 1 day greater than 5% change. Table 3.12.19 below displays predicted visibility changes for the RFD calculated using Method 6 for each Class I area.

Table 3.12.19: Visibility Method 6 for the Reasonably Foreseeable Development Scenario at Class I Areas

Class I Area	RFD Scenario			RFD Scenario Cumulative		
	% Change High Day 24-hour B_{ext} (Mm-1)	% Change 8th High Day 24-hour B_{ext} (Mm-1)	Days > 5%	% Change High Day 24-hour B_{ext} (Mm-m-1)	% Change 8th High Day 24-hour B_{ext} (Mm-1)	Days > 10%
Arches	5.05	3.01	1	155	91	104
Bandelier	1.45	0.79	0	114	64	148
Black Canyon of the Gunnison	4.63	1.6	0	108	76	109
Canyonlands	5.87	4.31	3	217	117	137
La Garita	1.95	0.63	0	174	71	122
Mesa Verde	9.76	7.14	29	452	278	323
San Pedro Parks	3.89	1.15	0	154	96	197
Weminuche	5.85	1.48	1	460	76	194
West Elk	2.86	1.21	0	311	53	111
Estimated maximum change in extinction coefficient (b_{ext}); number of days with extinction changes greater than 5% and greater than 10%.						

The cumulative impacts to visibility predicted by the model validate what was already known from existing visibility monitoring data. The existing condition of visibility in the region is already impaired from existing sources. All Class I area receptors modeled show that visibility would be impaired by emissions from the cumulative sources, based on a definition of impairment being a change in extinction of 10% or more compared to natural visibility conditions. It is important to note that the cumulative impacts are identical between the RFD scenario and the No Leasing Alternative. This suggests that development of the RFD scenario would not significantly change the existing level of visibility impairment.

With the exception of Chaco Culture National Historic Park, all the selected sensitive receptors for the Class II areas had predicted incremental impacts from the RFD scenario above the 5% AQRV threshold. Table 3.12.20 displays the estimated maximum change in extinction coefficient (b_{ext}) for the RFD calculated using Method 6 for each Class I area. Cumulatively, the model results reflect the current impaired visibility from existing sources seen in monitoring data. The cumulative impacts are identical between the RFD scenario and the No Leasing Alternative. This suggests that development of the RFD scenario would not significantly change the existing level of visibility impairment.

Table 3.12.20: Visibility Method 6 for the Reasonably Foreseeable Development Scenario at Class II Areas

Class II Area	RFD Scenario			RFD Scenario Cumulative		
	% Change High Day 24-hour B_{ext} (Mm-1)	% Change 8th High Day 24-hour B_{ext} (Mm -1)	Days > 5%	% Change High Day 24-hour B_{ext} (Mm -1)	% Change 8th High Day 24-hour B_{ext} (Mm -1)	Days > 10%
Canyon de Chelly	5.49	1.12	1	414	126	182
Canyons of the Ancients	22.92	8.77	40	465	164	360
Chaco Culture	2.77	1.08	0	421	136	210

Class II Area	RFD Scenario			RFD Scenario Cumulative		
	% Change High Day 24-hour B_{ext} (Mm-1)	% Change 8th High Day 24-hour B_{ext} (Mm -1)	Days > 5%	% Change High Day 24-hour B_{ext} (Mm -1)	% Change 8th High Day 24-hour B_{ext} (Mm -1)	Days > 10%
Hovenweep	7.88	3.11	1	285	133	272
Natural Bridges	5.27	2.04	1	232	88	95
Estimated maximum change in extinction coefficient (b_{ext}); number of days with extinction changes greater than 5% and greater than 10%.						

Cumulatively, the model results reflect the current impaired visibility from existing sources seen in monitoring data. The cumulative impacts are identical between the RFD scenario and the No Leasing Alternative. This suggests that development of the RFD scenario would not significantly change the existing level of visibility impairment. The same conclusions apply to Alternatives A, B, C, and D.

Because of the concerns about cumulative visibility impacts to nearby Class I areas, many mitigation measures were developed to reduce the pollutants that contribute to visibility impairment. The SJNF and TRFO would adopt many mitigation measures that would reduce emissions from oil and gas production and development activities on the SJNF and TRFO. These mitigation measures would reduce the pollutants NO_x, SO_2, VOCs, particulate matter, and other pollutants that impact visibility. This should reduce the small direct and indirect impacts to visibility from this project.

Greenhouse Gas Emissions and Climate Change

The assessment of so-called “greenhouse gas” emissions and climate change is in its formative phase; therefore, it is not yet possible to know with confidence the net impact to climate. However, the Intergovernmental Panel on Climate Change (2007:5, 10) recently concluded that “warming of the climate system is unequivocal” and “most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic [human-made] greenhouse gas concentrations.” The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts. Potential impacts to air quality due to climate change are likely to be varied and dependent on which climate scenario plays out.

Oil and gas development activities on the SJNF and TRFO are predicted to produce greenhouse gas emissions. The amount of CO_2 and CH_4 emissions associated with well development on new federal leases for the RFD scenario were estimated for well drilling, well completion, and gas production. Greenhouse gas emissions were not modeled in CALPUFF. Estimates of greenhouse gas emissions for oil and gas activities were calculated using assumptions from EPA AP-42 tables (EPA 1995) for different engines used for oil and gas drilling and production. The results are summarized in Table 3.12.21.

The RFD scenario is estimated to emit a total of 88,281 tons of CO_2 per year and 399 tons of CH_4 per year (9,975 tons of CO_2 equivalents as CH_4). By comparison, the CO_2 equivalent emissions of La Plata County for 2005 were estimated to be 5,019,511 tons, and in 2020 it is estimated they would decrease to 3,523,663 tons (La Plata County 2008).

Table 3.12.21: Greenhouse Gas Emissions, Reasonably Foreseeable Development Scenario

Emission Source	Gothic Shale Gas Wells		Paradox Conventional Wells	
	CO_2 (tons/year)	CH_4 (tons/year)	CO_2 (tons/year)	CH_4 (tons/year)
Drill rig engines	20,697	12	4,385	2.8
Hydraulic fracturing engines	2,996	2	155	0.1
Compressor engines	29,594	334	4120	46.9
Well pad separator/heaters	22,110	0.5	4224	.1
Total	75,397	348.5	12,884	49.9

The air quality impacts from Alternatives A, B, C, and D would be the same or very slightly less than the RFD scenario for all air quality parameters. This is because there is very little difference in the number of proposed wells for the RFD scenario compared to all alternatives.

No Leasing Alternative

The No Leasing Alternative was also analyzed to bracket the air quality impacts of oil and gas development in the Paradox Basin. The RFD scenario would represent the maximum possible impacts and the No Leasing Alternative represents the minimum impacts that could occur. The total number of wells analyzed for the No Leasing Alternative was 1,365 wells. The breakdown of wells that could be drilled in the Paradox Basin on already leased federal, state, and private lands are displayed in Table 3.12.22.

Table 3.12.22: Well Numbers on Current Federal Leases and on State and Private Lands

	USFS Leased Lands	BLM Leased Lands	State and Private Lands	Total
Paradox conventional	25 production 10 drilled/reclaimed	125 production 20 drilled/reclaimed	50	230
Paradox/GSGP	105 production 10 drilled/reclaimed	235 production 25 drilled/reclaimed	760	1,135
			Total (Paradox conventional and GSGP)	**1,365**

Nitrogen Dioxide: All NO_x emissions were conservatively assumed to be in the form of NO_2, which is the regulated Clean Air Act pollutant. The summary model results of the No Leasing Alternative compared to NAAQS and PSD increments are displayed in Table 3.12.23. The modeling demonstrated that the incremental (direct and indirect) impacts of the No Leasing Alternative would not cause exceedance of the NO_2 NAAQS for any Class I or Class II receptor in the modeling domain.

Table 3.12.23: Comparison of Maximum Predicted NO_2 Impacts Compared to National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments, No Leasing Alternative

NO_2	No Leasing Alternative	No Leasing Alternative Cumulative
NAAQS 1-hour	192 µg/m³ (100 ppb)	192 µg/m³ (100 ppb)
NAAQS annual	100 µg/m³ (53 ppb)	100 µg/m³ (53 ppb)
PSD Class I annual	2.5 µg/m³	2.5 µg/m³
PSD Class II annual	25 µg/m³	25 µg/m³
Max annual impact Class I	0.531 µg/m³	4.282 µg/m³

NO_2	No Leasing Alternative	No Leasing Alternative Cumulative
areas	Mesa Verde National Park	Mesa Verde National Park
Max annual impact Class II areas (latitude, longitude)	2.18 µg/m³ (37.20817702,108.8426431)	62.6 µg/m³ Near Four Corners Power Plant
Max 1-hour impact Class I areas	19.47 µg/m³ Mesa Verde National Park	157 µg/m³ Mesa Verde National Park
Max 1-hour impact Class II areas	18.45 µg/m³ Canyons of the Ancients National Monument	326 µg/m³ Chaco Culture National Historic Park

Cumulatively, the 1-hour concentrations of 326.00 µg/m³ at Chaco Culture National Historic Park are higher than the 1-hour NO_2 NAAQS (192 µg/m³). These cumulative impacts do not signify an actual violation. Rather, they show that cumulative impacts from existing sources may pose a problem and need to be carefully examined by the regulatory agencies prior to issuing permits for new construction in the area. The high NO_2 results at Chaco Culture National Historic Park are likely related to oil and gas and power plant pollution sources in New Mexico since the NO_2 1-hour concentrations are much lower at all receptors close to the Paradox Basin well field.

The informal PSD information presented in Table 3.12.23 above is provided at the request of the EPA, who was a stakeholder in the SJNF and TRFO air quality impact analysis. Its usefulness is to better understand potential project impacts to Class I areas. Most oil and gas emission sources are not considered PSD major sources under the Clean Air Act, and therefore the comparison is not a formal PSD increment analysis, nor is it intended to replace such an analysis. The BLM and USFS do not have the authority to conduct regulatory PSD increment analysis.

The direct project impacts of the No Leasing Alternative would not exceed the NO_2 Class I PSD increment (2.5 µg/m³) or the Class II PSD increment (25 µg/m³). The cumulative impacts to Class I PSD increment for annual NO_2 would be exceeded at Mesa Verde National Park at 4.282 µg/m³. The model results show that cumulative impacts to annual Class II PSD increment (25µg/m³) would be exceeded within the coarse grid of the modeling domain with a maximum annual NO_2 concentration of 62.6 µg/m³. This location is less than ~ 4.7 miles from the Four Corners Power Plant. This power plant emits over 49,000 tons per year of NO_x and is less than 8.5 miles from the San Juan Generating Station, which emits over 40,000 tons per year of NO_x. These are likely the significant contributing sources to the high localized NO_2 concentration. In addition, numerous existing oil and gas wells are in this part of New Mexico, and additional NO_2 sources are anticipated in this area in conjunction with the BLM Farmington Field Office RMP RFD (Engler et al. 2001).

Sulfur Dioxide: The direct contributions of the No Leasing Alternative to SO_2 concentrations at all receptors within the modeling domain are very small due to the low level of project-related SO_2 emissions (Table 3.12.24). Project SO_2 emissions would be generated primarily from diesel engines used during short-term well construction activities.

Table 3.12.24: Comparison of Maximum Predicted SO_2 Impacts Compared to National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments, No Leasing Alternative

SO_2		No Leasing Alternative	No Leasing Alternative Cumulative
NAAQS 1-hour		200 µg/m³ (75 ppb)	200 µg/m³ (75 ppb)
NAAQS 3-hour		1300 µg/m³ (0.5 ppm)	1300 µg/m³ (0.5 ppm)
PSD Class I (µg/m³)	3-hour	25	25

SO_2		No Leasing Alternative	No Leasing Alternative Cumulative
	24-hour	5	5
	Annual	2	2
PSD Class II (µg/m³)	3-hour	512	512
	24-hour	91	91
	Annual	20	20
Max impact Class I areas	1-hour	0.84 µg/m³ Mesa Verde National Park	187 µg/m³ Mesa Verde National Park
	3-hour	0.454 µg/m³ Mesa Verde National Park	131.83 µg/m³ Mesa Verde National Park
	24-hour	0.168 µg/m³ Mesa Verde National Park	25.27 µg/m³ Mesa Verde National Park
	Annual	0.060 µg/m³ Mesa Verde National Park	2.53 µg/m³ Mesa Verde National Park
Max impact Class II areas	1-hour	0.6 µg/m³ Canyons of the Ancients National Monument	209 µg/m³ Canyon DeChelly National Monument
	3-hour (latitude, longitude)	1.12 µg/m³ (37.2070686, 108.750069	2745 µg/m³ (36.72532681, 108.5526668)
	24-hour (latitude, longitude)	0.748 µg/m³ (37.2070686, 108.750069)	469 µg/m³ Near Four Corners Power Plant coarse grid
	Annual (latitude, longitude)	0.313 µg/m³ (37.2070686, 108.750069)	58.3 µg/m³ Near Four Corners Power Plant

Table 3.12.24 demonstrates that the direct contributions of the No Leasing Alternative produce very small concentrations of SO_2 for all averaging times and all receptors in the modeling domain. The direct and indirect oil and gas development associated with the No Leasing Alternative would not significantly contribute to any exceedance of the 1-hour, 24-hour, and annual SO_2 NAAQS.

The modeling indicates that, cumulatively, the 24-hour and annual SO_2 NAAQS (365 µg/m³) could be surpassed at 469 µg/m³ in the vicinity of the Four Corners Power Plant and San Juan Generating Stations. The location of the coarse grid maximum SO_2 impacts is in the same spot as the maximum concentrations of coarse grid NO_x and PM_{10}, which is near the Four Corners Power Plant (which emits over 27,000 tons per year of SO_2) and the San Juan Generating Station (which emits over 32,000 tons per year of SO_2). It is important to note that the GSGP and Paradox conventional projects would not emit appreciable SO_2; therefore, these modeled NAAQS exceedances for SO_2 are wholly due to existing sources and other reasonable foreseeable projects and not due to the projects under review for this FEIS.

These cumulative impacts do not signify an actual violation. Rather, they show that cumulative impacts from existing sources may pose a problem and need to be carefully examined by the regulatory agencies prior to issuing permits for new construction in the area. The very high SO_2 results near the New Mexico power plants should be viewed with caution. First, CALPUFF is not the preferred air quality model for receptors in the near-field (within 50 km of the source). Second, for this

model analysis, emission sources with similar stack parameters were combined in order to keep the number of sources modeled manageable. Therefore, Four Corners Power Plant and San Juan Generating Station were each modeled as a single stack. Although elevated SO_2 concentrations would be expected in the vicinity of the power plants, the accuracy of CALPUFF for these possible NAAQS violations is less certain. Again, the extremely low project emissions associated with the No Leasing Alternative (24-hour max concentrations at 0.748 µg/m³) would not contribute to cumulative SO_2 NAAQS exceedances in New Mexico.

Cumulatively, the 1-hour SO_2 concentrations at Canyon de Chelly National Monument at 209 µg/m³ are higher than the 1-hour SO_2 NAAQS (200 µg/m³). This receptor is not close to the Paradox Basin, and the No Leasing Alternative would emit extremely small quantities of SO_2 emissions. The high cumulative SO_2 1-hour concentrations are likely related to emission sources located in New Mexico and not to the wells in the Paradox Basin associated with this project.

The informal PSD information presented in Table 3.12.24 above is provided at the request of the EPA, who was a stakeholder in the SJNF and TRFO air quality impact analysis. Most oil and gas emission sources are not considered PSD major sources under the Clean Air Act, and therefore the comparison is not a formal PSD increment analysis, nor is it intended to replace such an analysis. The BLM and USFS do not have the authority to conduct regulatory PSD increment analysis.

The direct project impacts of the No Leasing Alternative are well below any Class I or Class II PSD increments for SO_2. This is due to the very low SO_2 emissions associated with the project. The cumulative impacts to Class I PSD increment for SO_2 would be exceeded at Mesa Verde National Park for all SO_2 concentration averaging times. Cumulative visibility impacts to Class I areas have long been recognized and are widely understood to be a problem across the country. This was the primary reason Congress promulgated the Regional Haze Rule.

The cumulative impacts to Class II PSD increments for SO_2 would be exceeded for all SO_2 concentration averaging times within the coarse grid receptors of the modeling domain.

Particulate Matter (PM_{10} and $PM_{2.5}$): The summary model results of the No Leasing Alternative compared to NAAQS and PSD increments are displayed in Table 3.12.25 and Table 3.12.26. The modeling demonstrated that the oil and gas development for the No Leasing Alternative would not cause exceedance of the PM_{10} and $PM_{2.5}$ NAAQS for any Class I or Class II receptors in the modeling domain.

Table 3.12.25: Comparison of Maximum Predicted $PM_{2.5}$ Impacts Compared to National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments, No Leasing Alternative

$PM_{2.5}$	No Leasing Alternative	No Leasing Alternative Cumulative
NAAQS annual (µg/m³)	12.0	12.0
NAAQS 24-hour (µg/m³)	35.0	35.0
Max annual impact Class I areas (µg/m³)	0.129 Mesa Verde National Park	1.086 Mesa Verde National Park
Max annual impact Class II areas (µg/m³)	0.334 Lat 37.2070686, Long 108.750069	2.84 Lat 37.19862825, Long 108.1947035
Max 24-hour impact Class I areas (µg/m³)	0.354 Mesa Verde National Park	7.07 Mesa Verde National Park
Max 24-hour impact Class II areas (µg/m³)	0.922 Lat 37.49677787,	15.2 Lat 36.72532681,

$PM_{2.5}$	No Leasing Alternative	No Leasing Alternative Cumulative
	Long 108.3722814	Long 108.5526668

Table 3.12.26: Comparison of Maximum Predicted PM_{10} Impacts Compared to National Ambient Air Quality Standards and Prevention of Significant Deterioration Increments, No Leasing Alternative

PM_{10}	No Leasing Alternative	No Leasing Alternative Cumulative
NAAQS 24-hour µg/m³	150	150
PSD Class I annual (µg/m³)	10	10
PSD Class II annual (µg/m³)	30	30
Max annual impact Class I areas (µg/m³)	0.355 Mesa Verde National Park	10.12 Mesa Verde National Park
Max annual impact Class II areas (µg/m³)	0.921 Lat 37.2070686, Long 108.750069	27.7 Lat 37.19862825, Long 108.1947035
Max 24-hour impact Class I Areas (µg/m³)	0.978 Mesa Verde National Park	66.97 Mesa Verde National Park
Max 24-hour impact Class II areas (µg/m³)	2.53 Lat 37.49677787, Long 108.3722814)	130.7 Lat 37.19862825, Long 108.1947035

The direct project impacts of the No Leasing Alternative would not exceed the PM_{10} Class I PSD increment (10 µg/m³) or the Class II PSD increment (30 µg/m³). The cumulative impacts to Class I PSD increment for PM_{10} would be exceeded at Mesa Verde National Park at 10.121µg/m³. The model results show that cumulative impacts to annual Class II PSD increment would not be exceeded within the modeling domain.

The informal PSD information presented in Table 3.12.26 above is provided at the request of the EPA, who was a stakeholder in the SJNF and TRFO air quality impact analysis. The BLM and USFS do not have the authority to conduct regulatory PSD increment analysis.

Deposition: The NPS deposition analysis threshold of 0.005 kg/ha-yr for nitrogen and sulfur for Class I areas was used to assess direct and indirect deposition impacts. Mesa Verde maximum nitrogen deposition was 0.0928 kg/ha-yr and maximum sulfur deposition was 0.020 kg/ha-yr. Mesa Verde National Park is adjacent to the proposed development areas in the Paradox Basin. Because the incremental agency threshold of 0.005 kg/ha-yr was exceeded for nitrogen deposition at Mesa Verde National Park, additional analysis and agency consultation was conducted (please see discussion for RFD scenario deposition impacts above). Many mitigation measures were adopted to decrease nitrogen pollution and reduce the deposition impacts to Class I areas.

For cumulative effects analysis, the NPS uses critical loads to determine significance of deposition on herbaceous plants and shrubs. For Mesa Verde National Park, the suggested critical load is 3.0 kg/ha-yr for nitrogen. The critical load for nitrogen has not been exceeded at any Class I areas in the modeling domain. The NPS has not yet determined critical loads for sulfur deposition; however, the USFS threshold of 3.0 kg/ha-yr for sulfur deposition has not been exceeded at any Class I areas in the modeling domain (Table 3.12.27). Detailed model results for all Class I area receptors can be found in the Air Quality Analysis TSD (Air Resource Specialists 2009).

Table 3.12.27: Nitrogen and Sulfur Deposition at the Mesa Verde National Park Class I Area from Leased and Unleased Lands in the Paradox Basin

Nitrogen and Sulfur Deposition Mesa Verde National Park	Wells on Currently Leased, State, and Private Lands (1,365 wells)	No Leasing Alternative Cumulative
Maximum direct nitrogen deposition impact (year)	0.0928 kg/ha-yr (2003)	1.603 kg/ha-yr (2001)
Maximum direct sulfur deposition impact (year)	0.020 kg/ha-yr (2003)	1.652 kg/ha-yr (2003)

ANC of Sensitive Lakes: No sensitive high mountain lakes in the Weminuche wilderness exceeded the ANC threshold when the direct and indirect impacts of the RFD scenario were considered. The changes to ANC from the No Leasing Alternative are displayed in Table 3.12.28.

Table 3.12.28: Percent Change Acid Neutralizing Capacity of High Mountain Lakes in the Weminuche Wilderness from Nitrogen and Sulfur Deposition, No Leasing Alternative

Mountain Lake	Threshold	ANC Change (%)		
		2001	2002	2003
Big Eldorado Lake (change from baseline ANC)	No more than 1 ueq/L decrease in ANC	0.224 (0.026 µeq/L)	0.11 (0.03 µeq/L)	0.142 (0.029 µeq/L)
Lower Sunlight Lake	< 10% change	0.026	0.032	0.026
Upper Sunlight Lake	< 10% change	0.078	0.096	0.077
Upper Grizzly Lake	< 10% change	0.076	0.093	0.074

Cumulatively, with the exception of Lower Sunlight Lake, ANC for all lakes was higher than the USFS AQRV threshold of 10% change. Cumulative changes to ANC from the No Lease Alternative are displayed in Table 3.12.29. The SJNF and TRFO would adopt many mitigation measures that would reduce nitrogen and sulfur emissions from oil and gas production and development activities on the SJNF and TRFO. This should result in no cumulative change to ANC or could reduce the impacts to water quality in these sensitive lakes.

Table 3.12.29: Cumulative Percent Change Acid Neutralizing Capacity of High Mountain Lakes in the Weminuche Wilderness from Nitrogen and Sulfur Deposition

Mountain Lake	Threshold	ANC Change (%)		
		2001	2002	2003
Big Eldorado Lake	No more than 1 ueq/L decrease in ANC	14.9 (3.04 µeq/L)	16.05 (3.27 µeq/L)	15.33 (3.13 µeq/L)
Lower Sunlight Lake	< 10% change	4.06	4.8	4.51
Upper Sunlight Lake	< 10% change	12.04	14.07	13.37
Upper Grizzly Lake	< 10% change	6.77	13.90	13.06

Visibility: Mesa Verde National Park was the only Class I area with predicted impacts above the 5% change AQRV threshold. The maximum visibility change was 7.8% for 16 days at Mesa Verde National Park. Table 3.12.30 below displays the estimated maximum change in visibility for the No Leasing Alternative calculated using Method 6 for each Class I area.

The cumulative visibility modeling analysis validates what was already known from review of existing visibility monitoring data, i.e., visibility in the region is already impaired from existing sources. All of the receptors modeled show that visibility would be impaired by emissions from the cumulative sources, based on a definition of impairment being a change in extinction of 10% or more compared to natural visibility conditions. The cumulative impacts are identical between the RFD scenario and the No Leasing Alternative. This suggests that development of the RFD scenario would not significantly change the existing level of visibility impairment.

Table 3.12.30: Visibility Method 6 for the No Leasing Alternative at Class I Areas

	RFD Scenario			RFD Scenario Cumulative		
Class I Area	**% Change High Day 24-hour B_{ext} (Mm-1)**	**% Change 8th High Day 24-hour B_{ext} (Mm-1)**	**Days > 5%**	**% Change High Day 24-hour B_{ext} (Mm-1)**	**% Change 8th High Day 24-hour B_{ext} (Mm-1)**	**Days > 10%**
Arches	4.02	2.34	0	155	91	104
Bandelier	1.04	0.57	0	114	64	148
Black Canyon of the Gunnison	3.08	1.15	0	108	76	109
Canyonlands	4.48	3.48	3	217	117	137
La Garita	1.42	0.47	0	174	71	122
Mesa Verde	7.80	5.88	16	452	278	323
San Pedro Parks	2.76	0.86	0	154	96	197
Weminuche	4.42	1.12	0	460	76	194
West Elk	1.99	0.81	0	311	53	111
Estimated maximum change in extinction coefficient (b_{ext}), Number of days with extinction changes greater than 5% and greater than 10%.						

Canyons of the Ancients National Monument was the only the Class II area with predicted incremental impacts from the No Leasing Alternative above the 5% change AQRV threshold. Table 3.12.31 displays the estimated maximum change in extinction coefficient (b_{ext}) for the No Leasing Alternative calculated using Method 6 for each Class II area.

Table 3.12.31: Visibility Method 6 for the No Leasing Alternative at Class II Areas

	RFD Scenario			RFD Scenario Cumulative		
Class II Area	**% Change High Day 24-hour B_{ext} (Mm-1)**	**% Change 8th High Day 24-hour B_{ext} (Mm-1)**	**Days > 5%**	**% Change High Day 24-hour B_{ext} (Mm-1)**	**% Change 8th High Day 24-hour B_{ext} (Mm-1)**	**Days > 10%**
Canyon de Chelly	4.32	0.85	0	414	126	182
Canyons of the Ancients	20.39	7.43	26	465	164	360
Chaco Culture	1.53	0.85	0	421	136	210
Hovenweep	4.54	2.81	0	285	133	272
Natural Bridges	4.20	1.60	0	232	88	95

Cumulatively, the model results reflect the current impaired visibility from existing sources seen in monitoring data. The cumulative impacts are identical between the RFD scenario and the No Leasing Alternative. This suggests that development of the RFD scenario would not significantly change the existing level of visibility impairment.

Because of the concerns about cumulative visibility impacts to nearby Class I areas, many mitigation measures were developed to reduce the pollutants that contribute to visibility impairment. These mitigation measures would reduce the pollutants NO_x, SO_2, VOCs, particulate matter, and other pollutants that impact visibility. This should reduce the small direct and indirect impacts to visibility from this project.

Greenhouse Gas Emissions and Climate Change

Greenhouse gas emissions were not modeled in CALPUFF. Estimates of greenhouse gas emissions for oil and gas activities were calculated using assumptions from EPA AP-42 tables (EPA 1995). The No Leasing Alternative is estimated to emit a total of 54,221 tons of CO_2 per year and 249 tons of CH_4 per year (6,225 tons of CO_2 equivalents as CH_4) (Table 3.12.32). By comparison, the CO_2 equivalent emissions of La Plata County for 2005 were estimated to be 5,019,511 tons, and in 2020 it is estimated they would decrease to 3,523,663 tons (La Plata County 2008).

Table 3.12.32: Estimated Greenhouse Gas Emissions, No Leasing Alternative

Emission Source	Gothic Shale Gas Wells		Paradox Conventional Wells	
	CO_2 (tons/year)	CH_4 (tons/year)	CO_2 (tons/year)	CH_4 (tons/year)
Drill rig engines	13,330	8	1,754	1
Hydraulic fracturing engines	1,885	1	62	0.1
Compressor engines	19,541	221	1,545	18
Well pad separator/heaters	14,520	0.3	1,584	0.3
Total	49,276	230.3	4,945	19.4

The air quality impacts from Alternatives A, B, C, and D would be greater than the No Leasing Alternative but the impacts would be the same or very slightly less than the RFD scenario for all air quality parameters. This is because Alternatives A, B, C, and D have essentially the same number of wells proposed compared to the RFD scenario

Mitigation Measures

The air quality impact analysis indicates that some potentially significant environmental effects could occur with all alternatives. The SJNF and TRFO plan to require certain air pollution mitigation measures, which would be effective in reducing impacts to air quality.

NEPA analysis is typically conducted for oil and gas leasing and when permits are issued. This FEIS is the first NEPA analysis where lands that could be made available for lease are identified and stipulated. In a subsequent analysis stage, when there is a site-specific proposal for development, additional air quality impact analysis would occur. This typically occurs when an application for a permit to drill is submitted. Based on the analysis results, additional mitigation or other equally effective options could be considered to reduce air pollution.

Reducing NO_x emissions has several environmental benefits, including 1) decreased nitrogen deposition and associated ecosystem impacts, 2) decreased acidification of water chemistry at sensitive wilderness lakes, 3) reduced ozone precursors thereby reducing ozone formation, 4) reduced impacts to visibility from nitrogen aerosol species, and 5) improved ambient near-field air quality. Reducing VOC emissions has the benefit of reducing an ozone precursor, thereby reducing ozone formation and air toxics.

As stated in the air quality impacts analysis, the RFD scenario would produce very low levels of sulfur emissions due to the short duration of drilling and completion activities per well and because the produced gas is very low in sulfur. However, some sulfur reductions can still be achieved with the application of mitigation measures. The environmental benefits of sulfur emission reductions include 1) decreased sulfur atmospheric deposition and acidification of water chemistry at sensitive wilderness lakes, 2) improved ambient near-field air quality, and 3) reduced impacts to visibility from sulfur aerosol species.

Reducing particulate matter emissions would 1) improve ambient air quality, 2) reduce impacts to far-field visibility from aerosol particulates, and 3) improve near-field visibility and public safety. Much emphasis is also put into reducing CH_4 emissions from drilling and gas production activities. Reducing CH_4 emissions would reduce emissions of a significant greenhouse gas and increase CH_4 gas revenue sales benefitting both the operator and the federal government.

The Air Quality Modeling Study for the Four Corners Area (New Mexico Environment Department 2009) demonstrates that ozone reductions and improvement to visibility at Mesa Verde National Park are possible if high-level controls are implemented for both oil and gas operations and power plants throughout the Four Corners Region. The New Mexico Environment Department study emissions controls considered in detail for the oil and gas sector were VOC control for pneumatic devices, storage tanks, and venting practices. The controls considered for NO_x were emission reductions on combustion engines. The SJNF and TRFO considered these findings in addition to the public comments received on the Supplemental EIS when developing air quality mitigation measures for potential future oil and gas development on public lands in Colorado. Many LRMP standards, guidelines, and mitigation measures focus on the VOC and NO_x controls developed by the Four Corners Air Quality Task Force as a result of the Air Quality Modeling Study for the Four Corners Area (New Mexico Environment Department 2010).

In response to the concerns of the USFS and the NPS, several mitigation measures were considered to reduce the deposition of nitrogen within Weminuche wilderness and Mesa Verde National Park Class I areas. CH_4 gas emission reduction measures were also considered to minimize greenhouse gas emissions related to management activities on the SJNF and TRFO. The final suite of mitigation measures are summarized in Table 3.12.33.

Table 3.12.33: Summary of Mitigation Measures to Reduce Air Pollution Emissions, Reasonably Foreseeable Development Scenario

Mitigation Option	Potential Emission Reductions RFD Scenario	Implementation Mechanisms
Centralized liquid gathering systems and liquid transport pipelines	Reduce tailpipe emissions by 14.9 tons PM_{10}, 2.2 tons $PM_{2.5}$, 4.2 tons CO, 3.3 tons NO_x, 0.09 tons SO_2, 1.64 tons VOCs per year. Eliminate 90% of well field tanks and reduce tank venting emissions by 80%.	LRMP guideline
NO_x emission limit for	Reduce NO_x 50%–80% from existing	LRMP Standard

Mitigation Option	Potential Emission Reductions RFD Scenario	Implementation Mechanisms
engines < 300 horsepower	high NO_x emission engines on the SJNF and TRFO.	
NO_x emission limit for engines > 300 horsepower	Reduce NO_x 30% from existing high NO_x emission engines on the SJNF and TRFO.	LRMP standard
Reduced emission completions/recompletions	Capture an average of 53% of CH_4 gas and 95% VOCs, and condensate typically vented or flared during well completions and well work over.	LRMP standard
Improved drill rig engine technology (Tier 2 or best available)	Reduce NO_x, PM, CO, and VOC emissions.	LRMP guideline
Storage tank emission controls	Reduce 95% of VOC emissions.	LRMP standard
Use low bleed, no bleed pneumatics for new/retrofitted wells	90% CH_4 reduction compared to high bleed devices is 118.5 MMCF/year CH_4 emissions reduced (conservative estimate).	LRMP standard
Dehydrator emission controls	95% or better reduction in VOC emissions and 95% or better reduction in CH_4 emissions.	LRMP standard
Collocation and centralization of facilities	Reduce tailpipe emissions and other benefits.	LRMP guideline
Optimization of engines	Use lowest necessary horsepower, fewest engines, highest efficiency, lowest cumulative emissions. Estimated 30% reduction in emissions compared to current practices (Red Willow Production Company 2010)	LRMP guideline

Centralized Liquid Gathering Systems and Liquid Transport Pipelines

The USFS and BLM would require pipelines to transport condensate and other liquids for non-wildcat wells via pipelines and use centralized liquids gathering systems. This applies to both Paradox Basin conventional and shale gas wells.

Description: The current practice for Paradox Basin conventional and shale gas wells is to store condensate and other produced liquids in tanks on each well pad and transport liquids by truck. Storage tank venting is a large source of CH_4 and VOC emissions within the oil and gas sector, accounting for 11% of gas industry CH_4 emissions (EPA 2009). Pipeline transport of fluids to centralized facilities would reduce tailpipe emissions related to liquid transport and eliminates leaking tank emissions. Treating fluids at a centralized production and collection facility would allow more control of emissions. It is assumed that approximately 261,300 round trips per year are necessary to service producing GSGP wells at full build out. Emissions from well production related vehicle traffic would be 148.6 tons PM_{10}, 22 tons $PM_{2.5}$, 42.4 tons CO, 33 tons NO_x, 0.9 tons SO_2, and 16.4 tons VOC per year.

Environmental Benefits: Reduced truck traffic emissions, eliminated venting from storage tanks, and efficient emission control would result from pipeline transport. It is assumed that this option would

conservatively eliminate 10% of truck traffic associated with production wells and would eliminate 80% of well field tanks with 100% elimination of venting emissions where there are no tanks. This mitigation measure would reduce tailpipe emissions by 10% or 14.9 tons PM_{10}, 2.2 tons $PM_{2.5}$, 4.2 tons CO, 3.3 tons NO_x, 0.09 tons SO_2, and 1.64 tons VOC per year. It would also eliminate 90% of well field tanks and reduce tank venting emissions by 80%.

NO_x Emission Limit for Stationary Engines > 300 Horsepower and < 300 Horsepower

See air quality standards and guidelines listed in Chapter 2 of the LRMP. Emission control benefits from this measure were already accounted for in model results.

Reduced Emission Completions/Recompletions (green completions)

Reduced emission completions (as defined by the EPA Gas STAR program) are required for all oil and gas wells where technically feasible and would apply to most non-wildcat wells on the SJNF and TRFO.

Description: The current practice for drilling oil and gas wells in the Paradox Basin is to vent CH_4 gas directly into the atmosphere, or in some cases to flare CH_4 gas as part of the well clean-out process. Venting and flaring is the largest source of CH_4 emissions in the oil and gas sector (EPA 2009). Equipment is now available that would recover natural gas, condensate, and other materials that flow out of the well during clean out. Reduced emission well completion equipment includes mobile tanks, portable separators, sand traps, and portable gas dehydration units. The emission control benefits from this measure were already accounted for in model results.

Environmental Benefits: This mitigation measure would capture an average of 53% of CH_4 gas and 95% of VOCs vented or flared during well completions and recompletions.

Low Emission Drill Rig Engines

The USFS and BLM would require the use of best available technology drill rig engines as Tier 2 through Tier 4 drill rig engine requirements are phased in (the use of natural gas engine powered drill rigs, selective catalytic reduction, or other measures that reduce drill rig engine emissions may be acceptable substitutes). The required use of Tier 2 through Tier 4 engines as soon as manufacturing regulations phase in was a recommendation by the CDPHE and the EPA.

Environmental Benefits: The air quality model assumed drill rig engines of 1,500 horsepower (hp). Tier 4 standards for engines > 750 hp are 0.5 grams per horsepower-hour (g/hp-h) NO_x emissions and 0.075 g/hp-h particulate matter emissions.

Low-Bleed/No-Bleed Pneumatic Devices on All New Wells

No-bleed, low-bleed, or air-driven pneumatic devices are required for all new and retrofitted oil and natural gas production sites to reduce CH_4 and VOC emissions. Exceptions may be made for safety and operational requirements.

Description: For producing wells, pneumatic devices are the largest source of CH_4 losses in the oil and gas production sector. Installing low/no-bleed or air-driven pneumatic devices for new oil and gas wells can reduce CH_4 emissions by 90% or more compared to high-bleed devices. Pneumatic devices include controllers, positioners, and transducers.

Environmental Benefits: The USFS and BLM conservatively assume that low-bleed pneumatic devices save 100 thousand cubic feet (MCF) per year per well (90% reduction CH_4 emissions) compared to high-bleed devices. Up to 100 MCF per year CH_4 could be saved if low bleed pneumatics are used compared to high-bleed pneumatics.

Dehydrator Emission Controls

All new separators and dehydrators used for natural gas production must use 95% control efficiency or better for VOC emission and CH_4 emission reduction compared to uncontrolled emissions.

Description: Glycol dehydrators are the most commonly used dehydration equipment on the SJNF and TRFO. Glycol dehydration units typically create emissions of CH_4, VOC, and hazardous air pollutants. Low or no emission dehydration is possible through the use of different dehydration technology or by combining a variety of emissions reductions technologies.

Environmental Benefits: It is assumed only 20% of new wells would use dehydrators. This would reduce VOC emissions by up to 95% and CH_4 emissions up to 95%.

Replace High-Bleed Pneumatics with Low-Bleed/No-Bleed or Air-Driven Pneumatic Devices on Existing Wells

Operators would either replace or retrofit high-bleed controllers, positioners, and transducers with low-bleed, no-bleed, or air-driven devices.

Description: The cost to inventory and replace high-bleed pneumatics with low-bleed pneumatic devices on existing oil and gas wells located on federal land is not high compared to the value of CH_4 gas lost to the atmosphere. Most replacement costs are recouped in under 1 year, resulting in a large economic benefit for industry. This measure could be applied to any existing gas well on the SJNF and TRFO. A high-bleed pneumatic device is defined as having bleed rates of 6 standard cubic feet/hour or greater.

Environmental Benefit: It is assumed replacement/retrofit saves 100 MCF per year per well (90% reduction CH_4 emissions).

Additional Mitigation

In addition to the mitigation described above, several other air pollution reduction measures were considered and could be used at the discretion of the agencies if additional mitigation is warranted. The list below is not comprehensive.

Reduce Truck Traffic Emissions

Operators would transport water for hydraulic fracturing activities via pipelines or other conveyances to centralized storage for shale gas wells.

Description: Over 100,000 barrels or 4,200,000 gallons of water per well would be needed to hydraulically fracture a typical GSGP gas well. This analysis assumes that water would be hauled in by truck to tank batteries or reservoirs. The truck hauling round-trip calculations assume an average of 40% recycling of flow-back water from each well. Total tailpipe emissions for the RFD scenario associated with GSGP gas well completions are 48.3 tons PM_{10}, 7.19 tons $PM_{2.5}$, 1,152 tons CO, 894 tons NO_x, 24.8 tons SO_2, and 445 tons VOCs per year.

Environmental Benefits: For the RFD scenario for shale gas wells, assuming 60% of round trips to haul water could be eliminated by transporting water for hydraulic fracturing activities via temporary surface pipeline or other conveyances (or by drastically reducing the amount of water needed to drill a well for example by using CO_2 or other gas fracturing technology), this could translate into a conservative 45% reduction in tailpipe emissions associated with well completion truck round trips. Tailpipe emissions needed to install temporary, on the surface water conveyances were considered in the calculations. For the RFD scenario, conservative estimates of total emission reductions from this mitigation measure could be 22 tons PM_{10}, 3.2 tons $PM_{2.5}$, 518 tons CO, 402 tons NO_x, 11.2 tons SO_2, and 200.1 tons VOC per year.

Electric Compression

The USFS and BLM would require electric-powered well pad compression and instrumentation where feasible, typically where wells are within 0.5 mile of the electric power grid. This applies to both Paradox Basin conventional and shale gas wells.

Description: There is limited access to electric power in the Paradox Basin. It was estimated that 15% of Paradox Basin conventional and shale gas wells on federal lands could be within 0.5 mile of the electric power grid. Where feasible, wells within 0.5 mile of the electric power grid could use electricity to eliminate gas combustion for wellhead engines, as well as for electric instruments, controllers, actuators for automatic valves, and small pumps. On average, wellhead engines associated with each well for production of the GSGP were assumed to be 0.03 ton PM_{10}, 0.03 ton $PM_{2.5}$, 0.664 ton CO, 0.33 ton NO_x, 0.0001 ton SO_2, and 0.01 ton VOC per year. For Paradox conventional wells, small wellhead engine emissions for each well were assumed to be 0.02 ton PM_{10}, 0.02 ton $PM_{2.5}$, 1.93 ton CO, 0.97 ton NO_x, 0.001 ton SO_2, and 0.48 ton VOC per year.

Environmental Benefits: Emissions reductions for GSGP well reductions would be 4.11 tons PM_{10}, 4.11 tons $PM_{2.5}$, 91 tons CO, 45 tons NO_x, 0.01 ton SO_2, and 1.37 tons VOC per year. Paradox Conventional well reductions would be 0.82 ton PM_{10}, 0.82 ton $PM_{2.5}$, 79.13 tons CO, 40 tons NO_x, 0.04 ton SO_2, and 20 tons VOC per year.

Solar Telemetry and Well Automation

The USFS and BLM would require solar-powered telemetry to remotely monitor and control production wells and associated equipment. This mitigation option was suggested by the NPS (2010).

Description: Remote control and monitoring technology reduces tailpipe emissions related to service truck traffic. It is assumed that approximately 38,430 round trips per year are necessary to service producing GSGP wells at full build-out. Emissions from well production related vehicle traffic are 148.6 tons PM_{10}, 22 tons $PM_{2.5}$, 42.4 tons CO, 33 tons NO_x, 0.9 ton SO_2, and 16.4 tons VOC per year.

Environmental Benefits: Remote telemetry could eliminate 50% of truck traffic associated with production wells. This could reduce tailpipe emissions by 74.3 tons PM_{10}, 11 tons $PM_{2.5}$, 21.2 tons CO, 16.5 tons NO_x, 0.46 ton SO_2, and 8.2 tons VOC per year.

Selective Catalytic Reduction for NO_x Control on Lean Burn Drill Rig Engines

Drill rigs in the Paradox Basin utilize selective catalytic reduction large drill rig engines. This option requested by the NPS.

Description: Drill rig engines are a source of NO_x emissions for the planning area. Assuming 1,338 wells (Paradox Basin conventional and GSGP wells) are drilled on federal lands, this would produce 449 tons NO_x over the life of the LRMP. Selective catalytic reduction technology applied to lean burn drill rig engines can reduce NO_x emissions up to 90% (Johnson Mathey 2009).

Environmental Benefits: It is assumed that 25% of diesel drill rigs in southern Colorado use lean burn engines. The number of wells drilled would vary from year to year. This option could reduce 101.1 tons NO_x over the life of the LRMP assuming selective catalytic reduction technology can reduce NO_x emissions on lean burn engines by 90%.

3.13 Access and Travel Management

3.13.1 Introduction

Travel is associated with many of the activities that take place within the planning area. Both motorized and non-motorized access are important for promoting outdoor recreation, managing wildfire, managing livestock and wildlife, developing natural resources (including timber and minerals), gathering fuel wood, accessing private in-holdings, maintaining electronic sites and utility corridors, and managing and monitoring the planning area.

Modes of vehicle travel within the planning area include large commercial trucks, automobiles, pickups, four-wheel drive vehicles, snowmobiles, ATVs and OHVs, motorcycles, mountain bikes, and wheelchairs. Other travel modes include cross-country skiing, horseback riding, and hiking. Linear travelways within the planning area include roads that include paved highways, gravel and dirt roads, unimproved or primitive roads, four-wheel drive roads, and trails designated for motorized and/or non-motorized use. Motorized off-road and off-trail travel, often referred to as cross-country motorized travel, is allowed only in designated “open” areas.

This section of the FEIS provides information about the SJNF and TRFO transportation systems. It includes a description of the management framework relevant to each agency, a description of the current transportation system and corresponding issues and how aspects of the LRMP would aid in addressing the known issues. Finally, it provides an analysis of the direct, indirect and cumulative impacts related to each of the alternatives as they relate to access and travel management, and its interaction with several key public lands ongoing management activities.

Management Framework

The location, design, operation, and maintenance of roads and trails are specified in manual direction of the USFS and BLM, as well as the Watershed Conservation Practices Handbook (USFS 2006a) for the USFS. This direction assures that intended uses would be accommodated over time. Maintenance and other activity accomplishments on SJNF- and TRFO-administered roads are directly dependent on funding levels, which vary from year to year.

Laws

- **The National Forest Management Act of 1976:** The NFMA directs that roads be designed to standards appropriate for their intended uses and requires revegetation of temporary roads authorized under contract, permit, lease, or other written authorization within 10 years of termination of the written authorization.

- **The Federal Land Policy and Management Act of 1976:** This act provides the authority for providing road facilities. It requires the USDI to maintain an inventory of public lands and their resources and values, require the development of land use plans through public involvement; consider the principles of multiple use and sustained yield in the development of land uses plans, and conduct a review of roadless areas having wilderness characteristics.

Executive Orders

- **EOs 11644 and 11989:** These EOs provide for developing regulations for governing use of OHVs on federal lands to protect natural resources, promote public safety, and minimize conflicts among uses.

Regulations and Policies

- **36 CFR 212:** This provides the principle regulations for administration of NFS roads and motorized trails, requires designation of a motorized transportation system, and provides for use of oversnow vehicles on NFS roads, trails, and lands.
- **36 CFR 219:** This provides resource management requirements that cannot be met without putting a viable transportation system in place.
- **36 CFR 261:** This prohibits the use of motor vehicles off of the designated transportation system.
- **43 CFR 8340:** This establishes criteria for the designation of public lands as open, limited, or closed to the use of OHVs, and establishes controls governing OHV use in such areas.

Additional regulations and policies are directed by FSM 7700 (Travel Management); BLM Manual 9100 (Transportation Facilities); BLM Land Use Planning Handbook H-1601-1, Appendix C; BLM Manual 1626 (Travel and Transportation Manual–Public); BLM H-8342 Travel and Transportation Handbook, BLM Manual 9113 (Roads); and FSH 7709.55 (Travel Planning Handbook).

Travel Management

Currently, both the SJNF and TRFO are conducting travel management planning under agency-specific direction and planning processes. The USFS Travel Management Rule (36 CFR 212, Subparts A, B, and C) requires that each national forest designate a system of roads, trails, and areas for motor vehicle use by vehicle class and, if appropriate, by time of year. The rule addresses any future proliferation of user-created routes by prohibiting cross-country motorized travel (except in small designated areas). The BLM has similar requirements for motorized off-road use set forth in 43 CFR 8340 and 8342. While travel management plans developed under the USFS and BLM direction cited above would result in site-specific, route-by-route designations, the LRMP does not. Rather, the area classifications contained in the LRMP provide a framework for future route-by-route designation. The area classifications developed under the LRMP are described below.

On NFS lands, the LRMP classifies over-ground motorized suitability as unsuitable, suitable, or suitable opportunity areas. Road and motorized trail construction would not be permitted in unsuitable areas, such as wilderness and other areas where motorized use is not conducive for resource, habitat, and/or constructability reasons, or is prohibited. Suitable areas have an existing developed road and/or motorized trail system that, for the most part, serves the recreation and resource access need for a particular area. The road and motorized trail system in suitable areas would generally not be considered for expansion or substantial alteration of the transportation system. Suitable opportunity areas are those that have an existing road and/or motorized trail system, and where there is potential to improve the system by adding to the existing system of routes. Modifications to the

existing transportation system to address resource concerns or enhance recreational opportunities would be permitted within unsuitable, suitable, and suitable opportunity areas. Such modifications may include route relocation and decommissioning.

Oversnow motorized suitability on NFS lands is divided into two classes: unsuitable and suitable. Unsuitable areas include regulated areas, wilderness areas, and RNAs. Suitable areas allow for oversnow travel by snowmobiles when snow depth is sufficient to prevent damage to underlying vegetation and soils.

In accordance with definitions and criteria in 43 CFR 8340, the BLM classifies OHV management areas as closed, limited, or open to motorized travel. Motorized travel within closed areas, which include WSAs and RNAs, is prohibited. Motorized travel within open areas is not limited to specific roads and trails, but is allowed cross-country. Limited areas permit motorized use on designated roads, primitive roads, and motorized trails where site-specific travel management plan decisions have been made. In limited areas where site-specific travel management planning is not completed, interim travel management restricts motorized travel to existing roads and trails until a travel management plan providing site-specific route designations is completed on BLM lands within 5 years of LRMP implementation.

3.13.2 Affected Environment

Existing Conditions and Trends

Authorized Road and Motorized Trail System

Authorized roads and trails are those that the agencies manage as part of the transportation system. There are more than 3,000 miles of authorized USFS and BLM roads and more than 500 miles of authorized USFS and BLM motorized trails within the planning area. Authorized roads and trails may be permanent or temporary routes constructed to meet some access need. They are periodically maintained. USFS-authorized roads are assigned a maintenance category known as an “objective maintenance level,” which represents the maintenance target for a specific route. The BLM has a similar method of classification termed "maintenance intensities." Maintenance levels/intensities are assigned based on a set of criteria that describe how the road would be maintained. These criteria include considerations for protection of resources or improvements, the required road smoothness for the design operating speed, season of use, traffic volume and type, and whether dust production is acceptable. The USFS road maintenance levels are described in Table 3.13.1.

Table 3.13.1: U.S. Forest Service Road Maintenance Levels

USFS Maintenance Level	Standard
1	Assigned to intermittent service roads during the period of closure, which must exceed 1 year. Basic custodial maintenance is performed in order to protect resources and the road investment. Motorized travel is prohibited.
2	Assigned to roads open to use by high-clearance vehicles. The road surface is generally native material, which can vary from soil to rock. The roads are typically single lane and can have steep grades. Passenger vehicles are not considered in maintenance. Traffic volume and speed is normally low. Motorized travel is accepted, but passenger vehicle use is generally discouraged.

USFS Maintenance Level	Standard
3	Assigned to roads open and maintained for travel by a prudent driver in a passenger vehicle. These roads are not maintained for user comfort. These are typically low-speed, single-lane roads with turn-outs. They may be either native or gravel surfaced.
4	Assigned to roads that provide a moderate degree of user comfort at moderate travel speeds. These roads are typically double lane and are gravel surfaced. Dust abatement may be employed.
5	Assigned to roads that provide a high degree of user comfort. These roads are typically double-lane, paved roads. Some are dust-abated, gravel-surfaced roads.

BLM roads within the TRFO are typically native-surface, high-clearance roads, corresponding to BLM Maintenance Intensity of 1, which corresponds to USFS roads maintained for high-clearance vehicles (Maintenance Level 2), and would be considered as such for the purposes of this analysis. Sometimes, the on-the-ground maintenance, known as the operational maintenance level/intensity, does not coincide with the objective maintenance level/intensity. Generally the operational maintenance level/intensity is at, or below, that of the objective maintenance level/intensity. Table 3.13.2 presents a breakdown of BLM roads by objective maintenance level/intensity.

Table 3.13.2: BLM Road Maintenance Intensities

BLM Maintenance Intensity	Standard
0	Routes that would no longer be maintained and that are identified for removal from the transportation system.
1	Assigned to routes where minimum maintenance is required to protect adjacent lands and resource values. Routes are not maintained for regular traffic and may be impassable for extended periods of time.
2	Reserved.
3	Routes requiring moderate maintenance due to low volume use. Year-round access may not be provided, but generally provides resource appropriate to keep the road open the majority of the year. The surface is maintained to provide a reasonable level of riding comfort for prudent speeds. Drainage structures maintenance and roadside brushing is conducted as needed.
4	Reserved.
5	Routes that require high maintenance due to year-round needs, high traffic volume, or significant use. Maintenance is performed on a scheduled basis, occurring at least once annually, to conduct needed repairs or other maintenance necessary to keep the route in acceptable condition and resource protection.

The LRMP would guide transportation system investments to ensure adequate and safe roads and motorized trails are available for administrative and public use. The LRMP provides direction to agency officials to look for opportunities to reduce maintenance costs by several means, including maintaining roads to the minimal level needed for its use and decommissioning or transferring jurisdiction of roads that are no longer needed to support the agency mission.

Unauthorized and Unmanaged Roads and Motorized Trails

It is estimated that there are more than 3,000 miles of unauthorized and unmanaged roads and trails within the planning area (Table 3.13.3 and Table 3.13.4). These unmanaged roads and trails are not considered NFS or BLM system routes; therefore, they are not managed and are not assigned an objective maintenance level/intensity. These unmanaged routes tend to occur most often in areas that have been historically open to cross-country motorized travel. They may also develop on out-of-service temporary roads that were not decommissioned or decommissioned adequately to prevent continued unmanaged use. Maintaining an accurate inventory of these routes is difficult because they are continually being created and expanded through motorized use off of the designated motorized road and trail systems. These unmanaged routes can impact several important resource areas, principally watersheds and aquatic and terrestrial species and habitat. These unmanaged routes can be unsafe for motorized travel since many are located on poor alignments and none are maintained. In addition, travelers can face safety hazards or become lost on these unmaintained and unmapped routes.

Table 3.13.3: San Juan National Forest Road Miles

Maintenance Level	Standard	USFS Miles
1	Basic custodial care (closed)	1,167
2	Use by high-clearance vehicles	913
3	Suitable for passenger cars	602
4	Moderate degree of user comfort	79
5	High degree of user comfort	21
	Total Authorized Road Miles	**2,782**

Source: Infra Travel Routes Database (USFS 2012c).

Table 3.13.4: Tres Rios Field Office Road Miles

Maintenance Intensity	Standard	BLM Miles
0	Identified for decommissioning	Not inventoried
1	Use by high-clearance vehicles	319
2	Reserved	Not applicable
3	Suitable for passenger cars	Not inventoried
4	Reserved	Not applicable
5	High degree of user comfort/year-round access	Not inventoried
	Total Authorized Road Miles	**319**
Source: Tres Rios Field Office Road Maintenance Schedule (BLM 2012b).		

As discussed previously, the LRMP provides the framework of motorized suitability (unsuitable, suitable, or suitable opportunity for NFS lands and open, closed, or limited for BLM lands) to guide transportation planning. Existing unmanaged routes within closed area on BLM lands or unsuitable areas on NFS lands would not be considered for incorporation into the transportation system and would be prioritized for decommissioning. The existing road and trail networks in suitable areas on NFS lands generally meet current and anticipated future transportation needs, so unmanaged routes in these areas generally would be prioritized for decommissioning. Conversely, unmanaged routes in open or limited areas on BLM lands or suitable opportunity areas on NFS lands may be considered for incorporation into the transportation system through the travel management planning process.

Thirty-seven percent of the authorized roads within the planning area are closed to motorized vehicles (NFS Maintenance Level 1). These roads are closed for 1 year or more, but are kept on the system in a stored state for a planned or projected future need such as timber harvest or fuels reduction projects. Typically, these routes are revegetated and are roughened or shaped to minimize surface water runoff and erosion.

Forty percent of authorized roads within the planning area are managed for high-clearance vehicles, such as pickup trucks and four-wheel drive vehicles (NFS Maintenance Level 2/BLM Maintenance Intensity 1). These roads were designed for a single purpose, have a low traffic volume, are single-lane, and have surfaces consisting of native materials. Some native soil surfaces retain moisture and would rut severely if used when wet; some are prone to erosion and can be easily washed away if proper drainage is not maintained. Deferred maintenance needs totaled $2.2 million in 2012 and generally consist of surface blading and restoration of drainage features.

NFS Maintenance Level 3 roads, which make up approximately 19% of the authorized road system, are maintained in order to accommodate passenger vehicles. However, they do not necessarily provide a comfortable driving experience. These roads have aggregate surfacing, which may consist of pit-run or crushed gravel that has an expected life of 10 to 20 years when adequately maintained. Assuming an average life of 15 years, the SJNF and TRFO should resurface a minimum of 40 miles of Maintenance Level 3 roads per year. In recent years, resurfacing accomplishments have averaged about 10 miles per year due to budget constraints and competing priorities. This has resulted in a large deferred maintenance backlog for NFS roads (totaling more than $50 million in 2012).

Approximately 100 miles (3%) of planning area roads are maintained in order to provide a moderately to highly comfortable driving experience (NFS Maintenance Levels 4 and 5). NFS Maintenance Level 4 roads are generally two-lane gravel roads. NFS Maintenance Level 5 roads are generally two-lane paved roads. These roads experience the highest volume of traffic and are the most costly per mile to maintain. Deferred maintenance needs for these roads are quite high, totaling $8.7 million for Maintenance Level 4 roads and $2.7 million for Maintenance Level 5 roads in 2012.

BLM roads within the TRFO planning area have not been assigned maintenance intensity classifications as outlined in BLM Manual 9113 – Roads Manual (Release 9-390, October 21, 2011). BLM roads within the TRFO are typically native-surface, high-clearance roads, which corresponds to a maintenance intensity of 1 and would be classified as such for the purposes of this analysis. Of the 319 inventoried miles of BLM roads, approximately 173 miles are actively maintained, with approximately half of those receiving maintenance each year.

The LRMP addresses several issues related to the inventory and maintenance of roads on NFS and BLM lands. The LRMP emphasizes the need for the agencies to maintain a sustainable and minimum road system that provides safe and efficient access to public lands, which would aid the agencies in meeting maintenance objectives and reducing deferred maintenance. The travel management planning process would be used to identify the minimum transportation system needed based on access needs. Unneeded roads would be decommissioned or transferred to the appropriate jurisdiction. Roads would be maintained only to the level needed for its use. Commercial users would be held accountable for contributing to the maintenance of public lands roads used in their business operations. Road maintenance dollars would be prioritized for use in maintaining high value routes and reducing safety hazards. These LRMP components would aid in reducing deferred maintenance costs while maintaining necessary access to NFS and BLM lands.

The roads within the planning area are further classified into one of three functional class categories: arterial, collector, or local.

- Arterials: These roads serve as connections between towns, major county roads, or state highways, and are main thoroughfares through the planning area.
- Collectors: These roads link large areas of the planning area to arterials or to other main highways.
- Locals: These roads are usually single purpose transportation facilities accessing specific areas.

In general, arterial and collector roads are surfaced with asphalt pavement or aggregate material. Local roads are generally native-surfaced, except when the local road accesses developed recreation facilities (including a campground, picnic area, or trailhead), which often have improved surfacing. Road functional class contributes to establishing the appropriate standards to which a road is constructed and maintained (Table 3.13.5). The LRMP lists the reference documents that contain the standards that are to be used in design, construction, and maintenance of roads.

Table 3.13.5: San Juan National Forest and Tres Rios Field Office Road Miles by Functional Class

Functional Class	Miles
Arterial	134
Collector	451
Local	2,516
Total	3,101
Sources: Infra Travel Routes Database (USFS 2012c); Tres Rios Field Office Road Maintenance Schedule (BLM 2012b).	

Forest Highways

Forest highways are state-, county-, or USFS-administered roads that provide access to, and within, the planning area. They are designated under the Federal Lands Highways program of the Transportation Equity Act for the 21st Century. These routes qualify for highway trust funding for improvement or enhancement. Forest highway funding can be used for planning, design, and construction or reconstruction of these designated routes. Enhancement work may include parking areas, interpretive signing, acquisitions of scenic easements or sites, sanitary and water facilities, and pedestrian and bicycle paths.

Forest highways provide critical linkages to public lands within the planning area. They are necessary for access to the various geographic and topographically isolated regions within the SJNF and TRFO. In addition, they provide linkages for visitors traveling from outside the southwest Colorado region, as well as through the public lands to destinations beyond. The LRMP provides assurance these routes would be maintained to the standards commensurate with their use.

The seven forest highways within the planning area are listed in Table 3.13.6.

Table 3.13.6: Federally Designated Forest Highways

Forest Highway	State Highway, County, USFS Route Number	Name	Termini	Length (miles)
1	State Highway 145	Dolores – Rico	Dolores to Telluride-Placerville Road	60.22
2	U.S. Highway 550	Durango – Red Mountain	La Plata County Road 200 to Red Mountain Pass	56.33

Forest Highway	State Highway, County, USFS Route Number	Name	Termini	Length (miles)
8	U.S. Highway 160	Mancos – Hesperus	Montezuma-La Plata County Line to Hesperus	6.31
60	NFS Road 535	West Dolores	State Highway 145 at West Dolores River to State Highway 145 north of Rico	32.25
61	NFS Road 631	Piedra	U.S. Highway 160 to Williams Creek	21.43
63	Montezuma County Road 31/Forest Road 526/San Miguel County Road 44Z	Dolores – Norwood	Dolores to Norwood	57.96
64	County Road 501	Vallecito	Bayfield to Forest Road 602	19.32
Source: U.S. Department of Transportation, Federal Highway Administration (2007).				

U.S. Forest Service Road Maintenance Costs

Beginning in 1999, the USFS conducted road condition surveys in order to determine the actual cost of maintaining the road system to standard. Work items were also recorded in order to determine the cost of road maintenance deferred in previous years due to lack of funding. Finally, the road improvement work that would be necessary in order to bring the roads up to the desired maintenance level was identified and documented. The primary maintenance work items identified through this analysis are road surfacing, signing, drainage, brushing, gating, and installing cattle guards. Analysis of the data collected showed that the SJNF is substantially underfunded for the size of its managed road system (Table 3.13.7). The USFS has subsequently issued direction to conduct a travel analysis on each unit to determine the minimum road system that is needed to support resource management and recreation activities. Roads identified through travel analysis as not needed to support the agency's mission can then be prioritized for decommissioning, thereby reducing annual and deferred maintenance costs.

Table 3.13.7: Estimated Funding Needs for San Juan National Forest Road Maintenance and Operations

	Annual Maintenance		Deferred Maintenance	
Maintenance Level	$/mile	Total $	$/mile	Total $
1*	$100	$100,000	$100	$100,000
2*	$300	$270,000	$2,400	$2,200,000
3	$4,000	$2,400,000	$83,500	$50,300,000
4	$5,900	$470,000	$110,100	$8,700,000
5	$11,900	$250,000	$12,900	$2,700,000
Total		$3,490,000.00		$64,000,000.00
Source: Infra Travel Routes Database (USFS 2012c). Numbers are rounded to nearest hundred. *Estimated.				

Tres Rios Field Office Road Maintenance Costs

Historically, the BLM has maintained approximately 173 miles of high-clearance (Maintenance Intensity 1) roads annually at a cost of $20,000. This work consists predominantly of surface grading

and shaping to promote drainage away from the roadway. The remaining roads are unmaintained. Until recently, the BLM did not have a process for conducting condition assessments, which provides data for determining what the maintenance needs and associated costs. In 2011, the BLM issued new direction that provides procedures for conducting road and primitive road inventories and condition assessments. Until the inventory and condition assessments are complete on the TRFO, there is insufficient information to determine maintenance needs and deferred maintenance for TRFO roads and primitive roads.

Strategies that are currently employed, and would be continued to be used once the LRMP is finalized, to reduce maintenance costs and to allocate the limited maintenance funding include:

- seeking opportunities to transfer road management responsibilities to other jurisdictions (including counties), especially where the roads provide access to large private in-holdings and developments;
- working with partners in order to perform necessary road decommissioning and trail maintenance; and
- reducing road maintenance levels for low-value roads or converting low-value roads to trails.

Road Use

In recent years there has been a shift in the volume and mix of travel modes accessing the planning area. Traditionally, commercial use of the transportation system was dominated by the timber industry and, to a lesser degree, the oil and gas industry. Since the 1990s, commercial timber use has experienced a continual decline. Other commercial use of the transportation system, however, has experienced a marked increase (including oil and gas, outfitting/guiding, and recreational vehicle guided tours). Most forms of recreational travel have increased, some more noticeably than others, principally the use of OHVs and ATVs such as four-wheelers and utility vehicles. Some of this recreation demand has been driven by a local development surge that began in the late 1990s—a surge that has pushed the WUI closer to the public lands.

Oil, gas, and mineral exploration and development require roads to be available for drilling, construction, maintenance, and production. When these roads are constructed for the purpose of oil and gas exploration and development, these roads are generally not available for use by the public; however, they may be used by the agencies for resource management purposes. Roads accessing oil and gas lease sites require all-weather surfacing when year-round access is needed. An all-weather surface may be gravel, chip seal, or asphalt and is designed for use in wet and snow conditions and to withstand snow plowing. These roads would be constructed and maintained by the lessee. Access to these roads is from intersecting collector and arterial roads within the planning area that may be under state or county jurisdiction, but most are under SJNF and BLM jurisdiction.

One of the issues associated with roads constructed to support exploratory activities is increased traffic on associated collector and arterial roads, resulting in higher traffic volumes, increased truck traffic, and increased need for road maintenance. Also, these roads increase runoff and concentrate flows, which can result in resource impacts and damage to downgradient lands, roads, and other improvements. The LRMP addresses these issues by defining the key standards that apply in road development from the pre-construction phase through construction and a mechanism for single purpose roads to be decommissioned once they are no longer needed for that purpose. In addition, cross-jurisdictional coordination is encouraged at the planning phase to flush out and address any issues related to public land road development on the regional transportation system.

As use of the planning area increases, travel management planning is becoming an increasingly important tool for reducing resource impacts and coordinating uses. Over the past 20 years, the use of four-wheel drive vehicles, ATVs/OHVs, snowmobiles, and mountain bikes has increased dramatically. These uses have led to a proliferation of unauthorized and unmanaged user-created routes, especially in areas that have historically been open to cross-country motorized travel.

The SJNF and TRFO have used travel management planning as the process to identify the needed transportation system to support resource management and recreation on NFS and BLM lands within the planning area. The LRMP establishes that both agencies would continue to work closely with the public, as well as with local, state, Native American tribal, and other federal agencies, to identify access needs and to strike a balance between motorized and non-motorized use.

There is a current and future anticipated need to provide access for private in-holdings. Landowners within public lands have a reasonable right of access, commensurate with their use. Land management agencies are to regulate this access in order to limit resource damage. When private access becomes the dominant use or requires significant improvement of the roads, the users must contribute to maintenance or improvement of the roads. Otherwise, use must be limited to levels that would not result in unacceptable damage to the road.

Requests for in-holding access consist of both requests for new road construction and winter access. New access requests are expected to increase as land values increase, making development of in-holdings more profitable. Winter access requests are expected to increase as in-holding development increases, and as property owners seek to inhabit in-holding-located residences year-round.

The LRMP emphasizes that roads accessing private in-holdings must be authorized by the appropriate agency and are upgraded by the proponent when deemed necessary to meet agency standards for traffic type, volume, and season of use.

3.13.3 Environmental Consequences

Direct and Indirect Effects

General Impacts

Maintenance and Reconstruction: The ability of the SJNF and TRFO to maintain and reconstruct roads and trails to meet standards is a direct function of the funding allocated for that purpose by Congress. Congressional funding allocations vary from year to year, and units have no direct control or influence on allocations. Decisions of where to prioritize use of this funding on the ground is aided by a process known as travel analysis. Travel analysis prioritizes each route based on its value to the overall planning area, as well as its risk to the environment, the traveling public, and the SJNF and TRFO (in terms of loss of agency investment). None of the alternatives would alter this process or the ability to secure funding; therefore, there would be no difference between the alternatives for route maintenance or reconstruction.

Access Impacts

The agencies’ approach to providing access in and through NFS and BLM lands would not be altered by any of the alternatives. Coordination and collaboration with other federal, state, and county officials in the management of transportation facilities to, and through, the SJNF and TRFO would be continued in order to ensure that access is maintained, standards are consistent, safety issues are addressed, and the transportation system provides necessary, logical, and efficient route

connections. Reasonable access to private in-holdings would be provided. Existing ROWs and easements would be maintained, and future easements would be pursued as needed to ensure that there is appropriate public access to public lands.

Impacts Related to Travel Suitability and Management Area Designations on National Forest Service Lands

There is a relationship between the travel suitability areas and MAs on NFS lands. The areas identified as unsuitable for over-ground or oversnow travel and have boundaries similar to MA 1, which are wilderness areas or other areas where natural processes dominate. The areas identified as suitable or as suitable opportunity areas for over-ground travel or suitable for oversnow travel have boundaries that correspond to MA 3 (natural landscapes with limited management), MA 4 (high use recreation emphasis), MA 5 (active management), MA 7 (public and private land intermix), and MA 8 (highly developed).

These suitability classifications, along with MAs, would be the framework used in future travel management planning processes that would establish route-by-route designations. For example, areas mapped as unsuitable or MA 1 in the LRMP would not be considered for opportunities to expand the road or motorized trail system in future travel management planning efforts. Conversely, areas mapped as suitable opportunity areas in MA 5 would be focus areas for transportation system improvements, such as creating motorized recreation loops, in future travel management planning. This would have a positive impact on planning efforts by concentrating the focus on suitable and suitable opportunity areas. This is expected to reduce time and resources needed to complete future travel management plans.

MAs would influence the type and volume of traffic utilizing the transportation system in each specific area. For example, in MA 1, natural processes dominate and motorized transportation is prohibited, and as such motorized use is rare, consisting of unauthorized motorized use off of the designated transportation system, emergencies, or in support of national defense. In MA 4, recreational use dominates and motorized use is expected to be greater than all other MAs since these are concentrated along principal arterials, such as West Dolores Road, the Dolores-Norwood Road, and the Piedra Road. Traffic on roads within MA 4 includes a greater percentage of recreational vehicles (RVs) and truck and camper combinations since campgrounds are concentrated along the roads in these areas. Traffic in MA 5, where active management is concentrated, may include trucks and other vehicles that support commercial logging, livestock grazing on public lands, and oil and gas exploration and development, some of which requires year-round access. This could have a positive impact by aiding in aligning road design, construction, maintenance, and management with road use.

Impacts Related to Travel Off-highway Vehicle Area Designations on Bureau of Land Management Lands

OHV area designations on BLM lands would be used as the framework for future travel management planning efforts and would provide interim management direction for both over-ground and oversnow motorized use until site-specific decisions are made. Many of the BLM lands within the TRFO are currently unclassified and are effectively open to cross-country motorized travel. These areas would become designated as limited (on an interim basis) to existing roads, primitive roads, and trails under Alternatives B, C, and D. This means that motorized travel would be limited to the roads, primitive roads, and trails that exist at the time the LRMP is adopted, until a travel management plan providing site-specific, route designations is completed within 5 years of LRMP implementation on BLM lands. This would provide a positive impact by limiting OHV use to existing routes, resulting in fewer new

routes being created and fewer impacts to soils, watersheds, vegetation, and wildlife. These area designations would aid in the travel management planning process by concentrating the planning effort on those areas designated as open and limited and the existing routes within limited areas.

Alternative Comparisons for Over-ground Travel Suitability on National Forest Service and Bureau of Land Management Lands

Under Alternative A, the current over-ground and oversnow travel management direction for both NFS and BLM lands would remain unchanged from current direction. Alternatives B, C, and D would result in establishment of travel suitability classifications on NFS lands and OHV area designations on BLM lands.

For Alternatives B, C, and D, the areas classified as unsuitable (NFS) or closed (BLM) to motorized travel would increase by approximately 49% under Alternative D, increase by 83% under Alternative B, and increase by 119% under Alternative C. (See Maps 20–23 [Volume III, Appendix V] for motorized over-ground suitability and Maps 24–27 for the motorized oversnow suitability for a geographic representation of motorized travel suitability proposed under each alternative.) The primary reason for this major change is that each of the action alternatives would result in eliminating areas open to cross-country motorized travel, as is allowed under the current travel management on BLM lands.

The acreage identified as suitable for motorized travel on NFS lands and limited for BLM land would be the greatest under Alternative D (1.2 million acres), followed by Alternative B (1.1 million acres) and followed by Alternative A (942,000 acres), and the least under Alternative C (883,000 acres).

The acreage identified as suitable opportunity on NFS lands or open areas on BLM lands would be greatest under Alternative A (879,000 acres), followed by Alternative D (374,000 acres), Alternative B (304,000 acres), and Alternative C (286,000 acres).

In general, Alternative A would maintain the current management with expansive areas of BLM lands in the Gypsum Valley and Disappointment Valley area remaining open to cross-country motorized travel. In addition, many areas that are not conducive to motorized use, due to resource or constructability constraints, would remain available for consideration of new motorized use in future travel management plans. The transportation systems for each agency would continue trending toward being unsustainable in terms of resource management and fiscal management aspects.

Alternative B would eliminate cross-country motorized use and reduce the areas available for designation of motorized routes in future travel management planning efforts. Motorized use on all BLM lands currently open to cross-country motorized use would become limited to existing and primitive roads. On NFS lands, large tracks of non-motorized areas would be classified as unsuitable. The transportation systems for each agency would trend toward becoming more sustainable in terms of both resource management and fiscal management. Other than cross-country motorized travel, public land access and motorized recreational opportunities would be similar to current conditions except where there are resource or constructability constraints, such as steep topography.

Alternative C would eliminate cross-country motorized use and reduce the areas available for designation of motorized routes in future travel management planning efforts. Motorized use on all BLM lands currently open to cross-country motorized use would become limited to existing and primitive roads. On NFS lands, large tracks of non-motorized areas would be classified as unsuitable. The transportation systems for each agency would trend toward becoming more sustainable in terms

of both resource management and fiscal management, but public land access and motorized recreational opportunities would be greatly reduced from current conditions.

Alternative D would eliminate cross-country motorized use and reduce the areas available for designation of motorized routes in future travel management planning efforts. Motorized use on all BLM lands currently open to cross-country motorized use would become limited to existing and primitive roads. On NFS lands, large tracks of non-motorized areas would be classified as unsuitable. The transportation systems for each agency would trend toward becoming more sustainable in terms of both resource management and fiscal management. There would be somewhat greater motorized recreation and public lands access in some areas, including Hermosa Cliffs, Missionary Ridge, Nipple Mountain, and Jackson Mountain. Other than cross-country motorized travel, public land access and motorized recreational opportunities would be similar to current conditions except where there are resource or constructability constraints, such as steep topography.

Alternative Comparisons for Oversnow Travel Suitability on National Forest Service and Bureau of Land Management Lands

There is a key difference in how the oversnow suitability for NFS lands and the BLM OHV area designations would be managed for oversnow use. On NFS lands, in areas classified as suitable for oversnow motorized travel, use may take place anywhere within the area, given the snow depth is adequate to prevent vegetation and soil damage. On BLM lands, oversnow use is allowable by vehicles designed for that purpose when snow cover is adequate to protect the underlying vegetation and soils from the impacts of that use, except in closed areas, areas identified as big game severe winter relief and winter concentration areas (by CPW), and areas identified as occupied Gunnison sage-grouse habitat (by CPW). Since the existing BLM road, primitive road, and trail system has not yet been inventoried and site-specific designation not yet made, alternative comparisons for the purposes of this analysis would be made based on acres of BLM lands open, limited, or closed under the OHV area designations and NFS lands classified as suitable or unsuitable.

Under Alternative A, the current winter travel management direction and winter motorized travel suitability areas would remain unchanged, with more than 1.3 million acres suitable or open for oversnow motorized travel. Compared with Alternative A, oversnow motorized travel would be reduced the least under Alternative D, with 856,000 acres of suitable on NFS lands and designation of 443,846 acres of limited and 23 acres of open on BLM lands. Alternative B would further reduce oversnow use with 792,312 acres on NFS lands classified as suitable and designation of 429,782 acres limited and 23 acres open on BLM lands. Alternative C would result in the least area available for oversnow use with 587,000 acres classified as suitable on NFS lands and designation of 429,782 acres limited and 23 acres open on BLM lands. The primary reason for this reduction is that approximately 400,000 acres of BLM lands (located primarily in the northwest portion of the planning area), which are currently classified as open in Alternative A, would become classified as limited for oversnow motorized travel under all of the other (action) alternatives.

In general, Alternative A would maintain the current management with expansive areas open to oversnow motorized travel. Many areas would remain open that are not conducive to oversnow motorized use due to a lack of supporting infrastructure (parking, etc.), resource constraints, ongoing conflicts between motorized and non-motorized use, and wildlife considerations. Infrastructure necessary to support this use includes parking and turn-around areas and sanitary facilities. Direct impacts to the transportation system include safety hazards and traffic congestion on both NFS roads and state and county arterials at locations where unmanaged parking is occurring. In addition, many of these parking areas have no sanitary facilities, which could present health hazards and surface

water impacts during high use periods. Impacts related to resources, wildlife, and recreation are discussed in their corresponding sections.

Alternative B would reduce the areas available for oversnow motorized use from that of Alternative A by classifying the following areas as unsuitable: big game severe and critical winter range, areas of Molas Pass and Red Mountain Pass, and areas where snow is typically insufficient for oversnow motorized use. On BLM lands, oversnow use is allowable by vehicles designed for that purpose when snow cover is adequate to protect the underlying vegetation and soils from the impacts of that use, except in closed areas, areas identified as big game severe winter relief and winter concentration areas, and areas identified as occupied Gunnison sage-grouse habitat. This would reduce wildlife impacts and user conflicts by eliminating motorized oversnow use in severe and critical winter range, which would also increase the opportunities for non-motorized winter recreation.

Alternative C would provide the fewest areas available for oversnow motorized use by classifying unsuitable the following areas: big game severe and critical winter range, areas of Molas Pass and Red Mountain Pass, areas classified as roadless under this alternative, lands managed for wilderness charateristics, and areas where snow is typically insufficient. On BLM lands, oversnow use is allowable by vehicles designed for that purpose when snow cover is adequate to protect the underlying vegetation and soils from the impacts of that use, except in closed areas, areas identified as big game severe winter relief and winter concentration areas, and areas identified as occupied Gunnison sage-grouse habitat. This would reduce wildlife impacts and user conflicts by eliminating motorized oversnow use in severe and critical winter range, which would result in increased opportunities for non-motorized winter recreation. This may increase conflicts among motorized oversnow users by concentrating use to fewer areas and increasing competition for parking. Non-motorized oversnow recreational opportunities would be the greatest under this alternative with about 200,000 acres or greater classified as unsuitable for oversnow motorized than the other alternatives.

Alternative D would be most similar to Alternative A in areas available for oversnow motorized use. The principal difference would be eliminating big game severe and critical winter range and limiting oversnow motorized use on BLM lands to existing roads, primitive roads, and trails and areas designated as open. This would allow fewer opportunities for concentration of infrastructure maintenance and improvements, reducing the opportunity to address issues related to safety, parking and turn-around opportunities, and sanitation, relative to Alternatives B and C. This would reduce wildlife impacts and user conflicts in severe and critical winter range and increase the opportunities for non-motorized winter recreation in these areas.

Impacts Related to Timber Management

Timber management activities can result in the need for construction of new roads or reconstruction of existing roads in order to accommodate the resulting increased traffic volume and vehicle size. However, within the SJNF and TRFO, road construction has consisted of temporary roads. There generally is a need for road maintenance of the new or reconstructed roads developed to access timber, as well as existing collector and arterial roads used to transport timber off the planning area. Historically, not all commercial users, including timber companies, have obtained commercial use permits or have contributed to the full extent necessary to maintain and/or improve roads to accommodate their use. The LRMP establishes that greater emphasis be made to ensure commercial users operate under a road use permit, and their contribution to maintenance is commensurate with their use.

There may be a variety of impacts associate with road construction, whether for temporary or new roads. Road construction and timber hauling may potentially impact roadway safety due to increased

traffic volumes and mixing of construction vehicles and haul trucks with recreational traffic, including light-duty passenger vehicles, RVs, and ATVs/OHVs. Roads create zones of compacted soil that reduce the area available for infiltration of precipitation and results in increased runoff. Increased surface drainage can increase erosion and damage roads and associated structures. Other impacts may include increased noise and an increased need for dust abatement.

There may be long-term impacts related to temporary roads when decommissioning does not require recontouring. A temporary road that is not recontoured so that it blends in with the natural grade can contribute to the development of an unauthorized, unmanaged user-created route because it offers easy (minimal grade and vegetation obstructions) off-road access. Travel management planning both currently and subsequent to the LRMP would result in a transportation system that is well defined and illustrated on maps that are available to the public. Each agency has that authority to issue citations to individuals for motorized use that is not authorized or is inconsistent with the travel management designations. In addition, the LRMP requires project-specific plans for development and decommissioning of temporary routes, which would reduce the likelihood that future temporary roads would become unmanaged user-created routes.

Alternative Comparisons: Projected road construction projects related to timber management, which would be similar under all of the alternatives, would be negligible (estimated between 0 and 3 miles) over the life of the LRMP. The new road construction projected for Alternatives A and D is 3 miles and is 0.5 mile for Alternative B. No construction is projected under Alternatives C. These roads would be temporary and would not be made available for public use. The mileage projections for construction do not represent a major difference between the alternatives.

Over the life of the LRMP, the projected reconstructed road miles for timber management would vary under the alternatives, from 5.6 miles for Alternative C to 8.2 miles for Alternative D. Road reconstruction mileage projections do not represent a major difference between the alternatives.

Impacts Related to New Oil and Gas Development Leasing

Oil and gas development for both existing and new leases would require the construction of new roads and reconstruction of existing roads. The need for roads is a function of the estimated number of wells projected to be developed. For each alternative, estimated road needs during exploration and development are presented in Table 3.19.12 through Table 3.19.22. The projected oil and gas development could measurably increase road usage requiring roads be constructed or reconstructed to safely accommodate existing and proposed uses.

Common Impacts Related to All Road Construction and Reconstruction

Common impacts from road construction and reconstruction include increased storm water runoff, sedimentation, erosion, wildlife disturbance, noise, diminished visual quality, and increased traffic on state and county collector and arterial roads. In addition, new road construction increases the number of intersections along state and county collector and arterial roads, as well as on NFS and BLM roads. Increased intersections result in a greater number of potential conflict points between turning vehicles and those driving through the intersection. Greater intersections often result in increased traffic volumes as new destinations are added to the area. This increased traffic would likely require increased maintenance and could require reconstruction of segments of these roads. Increased commercial use may potentially increase safety hazards due to increased traffic and to mixing commercial vehicles with recreational traffic, such as light-duty passenger vehicles, RVs, and ATVs/OHVs.

Impacts Related to Road Construction and Reconstruction in the Paradox Leasing Analysis Area

There would be an unprecedented increase in demand for agency services to review field development plans, road, and well pad designs, and monitor construction, maintenance, and reclamation activities associated with oil and gas development activities. This demand may also have a substantial impact by reducing agency funding and resources available to support other resource management activities and projects. This could impact the SJNF and TRFO's ability to effectively manage programs such as water resources, wildlife and fisheries, recreation, timber, transportation, cultural resources, range, and solid minerals.

All new oil and gas well access roads would be closed to the public and monitored. Upon well abandonment, all roads constructed specifically for the oil and gas wells would be removed, excepting those roads that the USFS/BLM retain for administrative purposes.

The amount of oil and gas related traffic on roads would vary between well construction phase and routine maintenance over the life of the well. Approximate 635 vehicle round trips consisting of heavy, medium, and light trucks are assumed to be needed for access road construction, drilling, and well completion and testing. Heavy truck traffic could result in accelerated wear to state, county, local, and USFS/BLM roads. Some of this impact may be offset by road maintenance activities conducted by the lessees and road impact fees paid by lessees to counties where oil and gas development occurs. A reasonable transportation projection assumes that active oil and gas wells and disposal or injection wells could continue to require daily maintenance trips and a workover on average every 2 to 4 years (six trips per workover). Consequently, 365 trips per well is assumed annually for maintenance, on average with an additional six trips over 1 to 2 days for an annual workover.

New road construction and improvements to existing roads done in conjunction with oil and gas development leasing would be concentrated in the PLAA, and not required in the NSJB and the San Juan Sag. There would be minimal to no oil and gas related road development in other portions of the planning area except where upgrades to the existing road system are necessary to meet increased traffic volume and heavy truck traffic demands. These upgrades may be required by the USFS, BLM, State of Colorado, counties, or other local governmental jurisdictions with road management authority. The speculative nature of mineral exploration makes it difficult to predict where, when, and how much road development would be needed until such time that industry submits a field development plan. An environmental analysis of industry field development plans would be conducted, which would include identification of environmental impacts associated with the proposed modifications to the transportation system and measures needed to mitigate those impacts. Mitigation measures may include use of specific design features, best management construction methods or procedures, alignment modifications, and decommissioning of unneeded roads.

In the NSJB leased area, there are currently over 50 miles of NFS and BLM open and administrative roads. It is projected that an additional 70 miles of NFS roads and 14 miles of BLM roads would need to be constructed to service current leases, and no new road miles are projected for future leases. For the purposes of this analysis, it is estimated that 20% of the existing roads, approximately 10 miles, would need to be reconstructed, which may include upgrading to an all-weather standard, to accommodate increased traffic volume and heavy truck use that is associated with CBM development on these existing leases. Road projections in the NSJB do not vary by alternative because all road construction and reconstruction would occur within existing leased areas. Therefore, there is no difference in impacts to access and travel management among the alternatives within the NSJB leased area.

In the San Juan Sag, there are currently approximately 200 miles of NFS open and administrative roads on leased and unleased lands. It is projected that an additional 2 miles of NFS roads would need to be constructed to service current leases, and an additional 12 miles of NFS roads would be constructed to provide access to future leases. Because of the high number of existing roads and low relative projected road construct need, it is estimated that just 5% of the existing roads, approximately 10 miles, would need to be reconstructed, which may include upgrading to an all-weather standard, to accommodate increased traffic volume and heavy truck use that is associated with oil and gas development in the San Juan Sag. Road projections in the San Juan Sag do not vary by alternative because the area available for lease does not vary by alternative, so there is no difference in impacts to access and travel management among the alternatives

In the PLAA, there are currently nearly 900 miles of NFS open and administrative roads. Currently, there are approximately 80 miles of NFS roads within currently leased areas of the Paradox Basin. For currently leased lands, it is projected that an additional 44 miles of NFS roads would need to be constructed to service the existing leases for each of the alternatives, including the No Leasing Alternative. As such, the number of road miles constructed for existing leases does not vary by alternative, so the impact to access and travel management from new road construction on existing leases do not vary by alternative. For unleased lands in the PLAA, Alternative A would have the greatest impact with 228 miles of new road construction projected, followed by Alternative D with 221 miles of projected new road construction, Alternative B with 214 projected new road miles, and Alternative C with 182 projected new road miles. The No Leasing Alternative has the least impact with no new road construction projected. The miles of road constructed correspond directly to the area available for lease under standard lease terms. Alternatives A and D have the most land available for lease under standard lease terms, which would permit road construction and surface occupancy. Alternative C has the greatest area classified as NSO or not available for lease, which would reduce or eliminate road construction in these areas. Alternative B areas that are identified for standard lease terms, NSO, and not available for lease are between Alternatives D and C, and this is reflected in the road miles projected.

In the PLAA, there are currently nearly 150 miles of BLM open inventoried roads, as well as 300 miles of county and other roads. Approximately 80 miles of BLM roads are within currently leased areas. For currently leased lands, it is projected that an additional 139 miles of BLM roads would need to be constructed to service the existing leases for all of the alternatives, including the No Leasing Alternative. The number of road miles constructed for existing leases does not vary by alternative, so the impact to access and travel management from new road construction on existing leases do not vary by alternative. For unleased lands, Alternative A has the greatest impact with 106 miles of new road construction projected, followed by Alternative D with 96 miles of projected new road construction, Alternative B with 78 projected new road miles, and Alternative C with 69 projected new road miles. The No Leasing Alternative has the least impact with no new road construction projected. The miles of road constructed correspond directly to the area available for lease under standard lease terms. Alternatives A and D have the most land available for lease under standard lease terms, which would permit road construction and surface occupancy. Alternative C has the greatest area classified as NSO or not available for lease, which would reduce or eliminate road construction in these areas. Alternative B areas that are identified for standard lease terms, NSO, and not available for lease are between Alternatives D and C and this is reflected in the road miles projected.

An estimate of the miles of existing roads that would need to be reconstructed as part of the PLAA development was done for the purposes of this analysis. Reconstruction needs would vary by the planned changes in use, such as traffic volume, type and season of use, and upgrades needed to accommodate these changes in use. Upgrades to accommodate increased traffic volume and heavy

truck use that is associated with oil and gas development may include alignment widening, graveling of native-surface roads, road resurfacing, all-weather surfacing, and minor realignments. It is assumed that Alternative A would have the greatest number of road miles to be reconstructed since it would have the greatest oil and gas development and need for new road miles. For Alternative A, it is estimated that 30% of existing NFS roads (72 miles), 50% of existing BLM roads (74 miles), and 10% of existing county/other (36 miles) roads would need to be reconstructed. The road miles projected to be reconstructed for the remaining alternatives is based on the percentage of new road miles projected for each alternative relative to Alternative A. For Alternative B, it is estimated that 68 miles of NFS roads, 66 miles of BLM roads, and 33 miles of county/other roads would be reconstructed. For Alternative C, it is estimated that 60 miles of NFS roads, 63 miles of BLM roads, and 30 miles of county/other roads would be reconstructed. For Alternative D, it is estimated that 70 miles of NFS roads, 71 miles of BLM roads, and 35 miles of county/other roads would be reconstructed. For the No Leasing Alternative, it is estimated that 12 miles of NFS roads, 42 miles of BLM roads, and 13 miles of county/other roads would be reconstructed. Although the reconstructed roads may or may not lie within leased areas, it is anticipated the miles would correspond directly to the area available for lease under standard lease terms, as these roads would serve as the arterial and collectors for the lease access roads. Alternatives A and D have the most land available for lease under standard lease terms, which would permit road reconstruction and surface occupancy. Alternative C has the greatest area classified as NSO or not available for lease, which would reduce or eliminate road reconstruction in these areas. Alternative B areas that are identified for standard lease terms, NSO, and not available for lease are between Alternatives D and C, and this is reflected in the road mile projections.

<u>Alternative Comparisons:</u> Alternative A would result in the highest level of road construction, followed by Alternatives D, B, and C, respectively. Impacts from an expanded transportation system and increased traffic to safety and other resources and uses of the public lands would follow the same order of magnitude from highest to lowest. Impacts would be controlled by LRMP standards, guidelines and additional referenced guidance, such as engineering and traffic control requirements that address road construction, maintenance, use, and abandonment. The road density guidelines of the LRMP would guide managers in determining where road construction may occur and where management strategies, such as road decommissioning or TL, are needed in conjunction with any new road development.

The No Leasing Alternative would not make available any new lands for lease and therefore there would be no direct or indirect impacts. Under the No Leasing Alternative, future development could occur on existing leases only and cumulatively could reduce the potential development and associated road needs by 35% (Alternative A) to 42% (Alternative C), resulting in less impact than the action alternatives.

Impacts Related to Recreation

Table 3.13.8 summarizes, by alternative, the changes in road and motorized trail miles that could result in adoption of the travel suitability and OHV area classifications for over-ground motorized travel during the travel management planning processes. This illustrates that Alternative C could result in the greatest (35%) reduction in motorized trail miles and the greatest (1.7%) reduction in road miles. Alternative C has the greatest impact on motorized use since it has the greatest area of NFS lands classified as unsuitable over-ground motorized travel and BLM lands classified as closed. Alternative B could result in a 5% reduction in motorized trail miles and a 0.1% reduction in road miles. Alternative D could result in a no reduction in motorized trail miles and a 0.1% reduction in road miles. Alternative A would continue current travel management direction and therefore could not directly result in any reduction of motorized trail or road miles available for public use. (See Section

3.14, Recreation, for an evaluation of the recreational opportunity impacts related to reducing the available miles of designated roads and motorized trails.)

Table 3.13.8: Estimated Change Due to Travel Management Suitability and OHV Area Designations

Route Type	Approximate Change in Mileage by Alternative			
	A	B	C	D
Road	0	-3	-54	-4
Motorized trail	0	-23	-175	0
Notes and Assumptions: Road and motorized trail miles were calculated using the geographic information systems (GIS) data current as of July 12, 2012. Road and trail mile reductions were calculated from the existing mileage of roads and motorized trails currently designated for public use that are situated within areas identified as unsuitable for motorized travel that correspond to each of the alternatives.				

Impacts Related to Travel Management from Wildlife

Wildlife habitat improvements and seasonal restrictions for key habitats (including winter concentration areas, winter severe range, and spring calving/fawning areas) may lead to fewer miles of road open to motorized travel in certain areas. Habitat improvements may include reducing road densities through decommissioning roads, rehabilitating abandoned roadbeds, and allowing the growth of cover vegetation along road corridors. Seasonal closures are used in order to protect wildlife during critical periods while, at the same time, allowing for motorized use during less critical times.

Protection measures for Canada lynx and lynx habitat may result in minor impacts to road-related activities by seasonally limiting road use. In terms of lynx protection, there would be no difference between the alternatives. The protection measures identified are already required under current SJNF and TRFO policies and procedures, in compliance with the ESA and the LCAS.

Wildlife management strategies would apply regardless of the alternative selected; therefore, there would be no difference between the alternatives in terms of impacts related to wildlife management.

Cumulative Impacts

Impacts Related to Providing Access to Private Land In-holdings

The following impacts are predicted to be the same under all of the alternatives, since the influence of private land development would be similar under each alternative.

Historical Impacts

Since the late 1990s, there has been a surge in residential and commercial development in southwest Colorado. This has resulted in increased land values and changes in land use. Increased land values have made the development of in-holdings highly profitable.

Current Impacts

The planning area is experiencing mounting pressure from private land in-holding owners to provide reasonable access, as provided under the Alaska National Interest Lands Conservation Act. This issue is further complicated when system roads pass through some portion of an in-holding and then continue on to provide public lands access.

<u>Foreseeable Future Impacts</u>

There may be several cumulative impacts related to providing access to private land in-holdings. Increased road miles and densities are expected to have the longest reaching cumulative impacts because this would have connected impacts on road maintenance. Development of in-holdings, including oil and gas development, would increase traffic on SJNF and TRFO roads—roads needed for access to the development. This may result in an increased need for maintenance and may require upgrading some public lands roads to all-weather roads. Where routes pass through private in-holdings, legal agreements and/or ROW easements may be needed. In cases where a road, or a segment of a road, becomes primarily a private in-holding access road, it may be appropriate to transfer the jurisdiction to the county.

Impacts Related to Providing Access to Utility Corridors

The demand for utility corridor access is expected to increase, regardless of the alternative selected; therefore, there would be no difference between the alternatives for the following cumulative impacts.

<u>Historical and Current Impacts</u>

The southwestern region of the United States has experienced a surge in oil and gas and electrical energy development. This surge has created a demand for creating new utility corridors, and upgrading existing utility corridors, in order to convey fuel and power economically. These corridors cross many miles of public lands and are generally linear in construction. Some impacts during construction (predominantly those related to ground disturbance for corridor installation and construction of temporary roads, including sedimentation, erosion, and increased runoff) would be relatively short lived. These impacts would diminish with the re-establishment of vegetation over time. Other impacts related to the operation of the utility corridor would continue for the life of the facility (including increased runoff, sedimentation, and erosion due to increased road densities; visual impacts resulting from linear corridor and access roads contrasting with the surrounding natural areas; increased disturbance to wildlife; and impacts to “quiet-use” recreation when the corridor crosses an otherwise non-motorized area).

<u>Foreseeable Future Impacts</u>

Existing utility corridors are aging, with some facilities in excess of 30 years old. These aging facilities are often in need of maintenance or replacement. Utility company requests for permanent roads to construct, maintain, and replace facilities have increased in recent years. These requests may result in new road construction and increased road densities. Increased road miles and densities would have connected impacts on aquatic resources, aquatic species, and wildlife. These types of roads are generally closed to public use; therefore, no impacts related to public traffic are expected. Road use permits would be issued for commercial use, requiring more agency staff time to manage the permits.

Impacts Related to the Northern San Juan Basin Coalbed Methane Project (NSJB-CBM)

<u>Historical Impacts</u>

A ROD was issued in April 2007 for the NSJB-CBM project that would allow for the development of CBM on NFS, BLM, and private lands within the project area. For the purposes of this analysis, it is assumed that the project would reach full build-out, as described in the NSJB-CBM FEIS and associated ROD (BLM and USFS 2006a).

The project calls for the construction of 226 well pads. Twenty-seven would be located on BLM-administered lands, 100 would be located on NFS lands, and the remaining 99 would be located on private lands. Access would be provided by the construction of 92 miles of roads. Eight miles would be located on BLM-administered lands, 64 miles would be located on NFS lands, and 20 miles would be located on private lands. These roads would not be open for use by the public. The operators would be responsible for construction, maintenance, and the prevention of public access. They would also be responsible for obtaining required easements, ROWs, and permits; controlling noxious weeds; and complying with agency and landowner requirements. Maintenance would blading, ditch and drainage facility cleaning, graveling, and applying dust palliative. The roads would be temporary and the operators would be responsible for reclaiming and revegetating the roads on public lands following project completion.

Since implementation began in 2008, it is estimated about 20% of the road and well pad construction has been completed. Impacts associated with this work include increased storm water runoff, sedimentation, erosion, increased traffic on state and county roads, and diminished visual quality.

<u>Foreseeable Future Impacts</u>

Resource impacts are disclosed in the NSJB-CBM FEIS and would include increased storm water runoff, sedimentation, erosion, wildlife disturbance, noise, increased traffic on state and county roads, and diminished visual quality (BLM and USFS 2006a). The proposed contribution of the road miles constructed and reconstructed as part of the NSJB-CBM project road development is approximately 20% of that estimated for the PLAA. The cumulative impacts would be an increase of the impacts associated with road construction and maintenance during the life of the NSJB-CBM project. These impacts would be diminished as the roads are reclaimed and revegetated; however, these areas are not expected to ever reach pre-existing conditions.

Impacts Related to Oil and Gas Development on Leased Lands in the Paradox Leasing Analysis Area

<u>Foreseeable Future Impacts</u>

The cumulative effects boundary for this analysis is the PLAA of the planning area, which includes the GSGP, as well as the adjacent area with conventional and gas shale development in Montezuma, Dolores and San Miguel Counties, and includes the potential impacts from projected oil and gas development on leased and unleased federal lands and private and state leases. The three counties that would be most directly impacted by projected development include Montezuma, Dolores, and San Miguel Counties. The three counties are expected to experience low to moderate increases in traffic reflecting a projected increase in population of nearly 20% by 2020. An increase in population growth simultaneous with projected oil and gas development could contribute to increased road congestion on road systems within the potentially impacted counties.

In addition to the potential miles of road described above for unleased lands, there are also projections for more development and roads on lands already leased. An additional 189 miles of road could result from future development on lands currently held under lease on federal mineral estate (112 miles from future gas shale development and approximately 77 miles from conventional gas development). Furthermore, approximately 265 additional miles are projected from development on private and state leases. Cumulatively, a total of 885 miles of road could result throughout the area from conventional and shale gas development on federal leases (including road miles associated with existing wells and projections for federal leased and unleased lands, and from existing development and potential development on private and state lands).

Other uses of the forest such timber harvest, livestock grazing, and recreation are all activities that could contribute along with oil and gas development to traffic on the federal, state, and county transportation systems. Community expansion and recreational use of the public lands are projected to moderately increase over the next 15 to 20 years. These trends, in addition to projected oil and gas development, could result in increased traffic congestion, wear and tear on roads, the need for more frequent maintenance, and an increased potential for traffic accidents.

3.14 Recreation

3.14.1 Introduction

Population growth, new recreation technology, and community interest have increased the focus on management of outdoor recreation settings and opportunities. Strategies incorporated into the various LRMP alternatives aim to maintain and enhance desirable recreation settings, integrate recreation with other resource objectives, provide for sustainable recreation experiences, and promote collaboration with local and regional partners in order to achieve recreation objectives.

Legal and Administrative Framework

- **The San Juan-Rio Grande National Forest Wilderness Management Direction decision signed August 3, 1998:** This provides direction for the administration of wilderness areas on the San Juan and Rio Grande National Forests.
- **36 CFR 212:** This provides direction for the administration of the Forest Transportation System; the designation of roads, trails, and areas for motor vehicle use; and use by oversnow vehicles.
- **36 CFR 251:** This provides overall direction for land uses, including miscellaneous land uses; special uses (outfitters/guides, for example); appeal of decisions relating to occupancy and use of NFS lands; and access to non-federal lands.
- **36 CFR 261:** This provides general prohibitions on NFS lands.
- **36 CFR 290:** This provides direction for cave resources management on NFS lands. The rules of this part implement the requirements of the Federal Cave Resources Protection Act of 1988.
- **36 CFR 291:** This provides direction for the occupancy and use of developed sites and areas of concentrated public use on NFS lands, including admission fees, recreation use fees, and reservation fees.
- **36 CFR 293:** This provides direction for the administration and use of wilderness and primitive areas on NFS lands.
- **36 CFR 294:** This provides direction for special areas, including recreation areas and IRAs.
- **36 CFR 297:** This provides direction for the administration WSRs under Section 7 of the WSRA of 1968, which provides for the protection of the free-flowing, scenic, and natural values of rivers designated as components or potential components of the National Wild and Scenic Rivers System from the effects of construction of any water resources project.
- **FSM 2300:** This provides direction for management and planning in relation to recreation, wilderness, and related resources.
- **FSM 2709, 2710, and 2720:** These provide the legal framework for special uses on NFS lands.
- **FSM 7300:** This provides direction for planning, development, and managing facilities on NFS lands.

- **FSM 7400 and 7409.11:** These provide direction for administration and managing drinking water systems, wastewater systems, effluents, solid waste systems, and food services.
- **FSH 2309.18:** This provides direction for designing, building, and maintaining USFS trails.
- **43 CFR 8342:** This provides direction for the designation of areas and trails on public lands.
- **43 CFR 8340:** This provides direction to establish criteria for designating public lands as open, limited, or closed to the use of OHVs, and for establishing controls governing the use and operation of OHVs in such areas.
- **FSH 7309.11:** This provides direction for managing USFS facilities.
- **BLM Manual 8330:** This provides policy on reasonable accommodations for persons with disabilities.
- **BLM Handbook H-1601-01, Appendix C:** This provides minimum guidance for developing the recreation sections in an RMP.
- **BLM Washington Office IM 2006-060 (BLM 2006b):** This provides direction for incorporating benefits-based management in the recreation program.
- **BLM Washington Office IM 2007-043 (BLM 2007b):** This transmits the “Unified Strategy” describing how best to implement the BLM Priorities for Recreation and Visitor Services Workplan (Purple Book), as outlined in IM 2006-060.

Existing Conditions and Trends

There are five components that describe existing recreation conditions within the planning area, as follows:

- **Recreation Profile:** This section presents and analyzes the question: What role do public lands play in local and regional lifestyles, and in offering attractions and activities for tourists?
- **Recreation Demographics and Demand Trends:** This section presents and analyzes the question: What do recreation trends suggest about the future of recreation within the planning area?
- **Dispersed Recreation:** This section presents and analyzes the question: What are the important activities and settings that currently characterize dispersed recreation uses within the planning area?
- **Recreation Facilities and Funding:** This section presents and analyzes the question: Within the context of reduced budgets, how can the SJNF and TRFO meet the increasing demand for recreation through partnership opportunities and other non-traditional methods? What realignment of facilities makes sense?
- **Recreation Issues and Need for Change:** This section presents and analyzes the question: Do existing conditions and public scoping comments illuminate the need for change regarding recreation settings, capacities, markets, and suitability? (Preliminary revision issues are identified.)

3.14.2 Affected Environment

Recreation Profile

Outdoor adventure in southwest Colorado has a reputation for diversity and excellence, and its appeal is contagious. More than two-thirds of a random sample of prospective visitors views Colorado as an “exciting” place. Portions of the planning area near communities are gaining social value due to the increasing demand for the available recreation settings. Aging Baby-Boomers and people engaging in amenity migration are helping establish more active (and less “retired”) populations settling near the planning area boundaries. Many residents value the ability to access the planning area near their homes conveniently, for a variety of recreational activities.

Tourism: The spectacular landscape of the San Juan Mountains continues to fuel the tourist economy, regardless of whether visitors actively engage in planning area recreation. For many, proximity and views are enough of a draw to bring them to the region. Colorado, as a whole, attracts visitors who embrace its image as a place for adventure and recreation. Table 3.14.1 through Table 3.14.4 below describe the tourism profiles for each of the geographic areas in the planning area.

Outdoor recreation accounted for approximately 31% all travel into Colorado (including business travel and skiing). According to the America’s Byways Resource Center (2004), the total vehicle miles traveled on the San Juan Skyway nearly doubled between 1990 and 2002. Other sections of scenic highway not designated as a scenic byway (including Wolf Creek Pass) are experiencing the same surge in scenic driving. Other visitor surveys (National Visitor Use Monitoring [NVUM], Fort Lewis College surveys [2001]) have found that sight-seeing is the most common activity, and that scenery is the most highly valued resource. Section 30 of the LRMP addresses Scenic and Backcountry Byways in more detail.

Outdoor Recreation Industry: A variety of attractions and activities, during all seasons, provide a stable tourism industry.

Tourists make up the majority of the market for guided outdoor recreation on public lands; however, the skiing and outdoor equipment industries are equally fueled by local dollars. These industries are important to the regional economy, as well as to the fiscal well-being of the sales tax dependent local governments.

Winter Sports: Downhill skiing in developed ski areas, primarily operating on federally managed public lands, is expected to continue as a huge draw for winter tourists in Colorado. Silverton Mountain, Durango Mountain Resort, and Wolf Creek ski areas play an important role in the communities and economies within the planning area. The ski industry is a large seasonal employer in the region. During the winter of 2003, skiing in La Plata County ranked as the number one private sector job provider.

Winter recreation has been impacted in recent years by the increase in population in southwest Colorado. This has resulted in an increased demand for access to recreational opportunities on snow. In addition, snowmobiles have increased in power and reliability, allowing them to access more terrain. Backcountry skiers now also have better equipment, and there has been an overall surge in adventure skiing. Another emerging sport is hybrid skiing, which is where a snowmobile tows or carries a skier or snowboarder up hills. During the past several decades, backcountry skiers and snowmobilers have had some success in resolving differences regarding where these groups could recreate without conflict. This cooperation has been challenged by the increase in number of users, as well as by changes in technology. The overall increase in winter uses of all types, particularly at

mountain pass areas along primary highways, has consistently brought use conflicts to the attention of the USFS and BLM. The winter sports conflicts are addressed in the alternatives.

River Running and Fishing: The planning area offers some of the highest quality fishing in the United States. From the San Juan Mountain high country to the semiarid San Juan River tailwaters, world-class fishing awaits the angler year-round. Boating is another strong recreational asset of the planning area. Large reservoirs (including McPhee, Williams, Vallecito, and Lemon) offer recreational boating in a mostly natural, scenic setting. Numerous rivers (including the Dolores, Animas, and Piedra) support a robust and beneficial commercial river-running economy.

Second Homes and Amenity Migration: Many of the attributes that attract people to visit the San Juan Mountains also prompts some to move, or buy a second home, in the area. Vacation and/or second homes are an economic driver in many local communities, fueling regional economies with outside dollars. This occurs while they are being built (related to construction, development, real estate, and finance), as well as after they are built (related to maintenance and local spending of occupants).

Table 3.14.1: Tourism Profile of the Dolores Geographic Area

Profile Component	Information
Terrain and access	The Dolores geographic area has the widest variety of terrain and climate zones of all three districts, ranging from the high peaks in the La Plata Mountains to the desert country downriver of McPhee Reservoir. The most extensive and signature country is the foothills and mesas terrain stepping off the La Plata, Rico, and Wilson Mountains. Due to a long history of grazing and logging on these relatively flat mesas and foothills, road access to this area is extensive and well developed. The flat topography also increases the impacts associated with illegal off-road driving.
Feedback from area residents	Due to the recent roots in traditional uses of the SJNF and to the long-established and extensive network of access roads on the Dolores District, people on the west end of the planning area have a noticeably strong multiple-use ethic. The idea that the public lands offer recreational opportunities for all types of users was a common refrain from the 2005 Dolores Public Lands Office study groups. Many recognize the challenge of multiple uses; most, however, would prefer to avoid a high degree of use segregation. Most people favor limiting motorized travel to established routes. With the exception of fairly widespread concern about gas well development, the majority of Dolores Public Lands Office residents are tolerant, and even supportive, of traditional uses within the planning area.
Strongest recreation – tourism asset	Diversity of terrain and plentiful road access offers a variety of opportunities and disperses uses to many different areas.
Recreation – tourism economy	Mesa Verde National Park and hunting are the largest tourist attractions in the area. The proximity to the mountains goes hand-in-hand with the agricultural lifestyles that many recent immigrants have come to enjoy in Cortez, Dolores, and other nearby communities. The planning area offers geographic and climatic relief for the thousands of people who live in the flatter, warmer, and drier terrains. Residents from around the Four Corners region can quickly access the mountains and higher ground to enjoy trails, rivers, streams, lakes, and scenic vistas.
Management challenge	Travel management is the number one recreation challenge, and the designation of travel access routes would profoundly influence the recreation setting and experience in this geographic area.

Table 3.14.2: Tourism Profile of the Pagosa Geographic Area

Profile Component	Information
Terrain and access	The Pagosa geographic area contains the Weminuche wilderness, which is the largest wilderness area in Colorado. The access opportunities to the wilderness for the Pagosa Public Lands Office are more numerous and geographically dispersed than other places within the planning area. Large open parks with rugged mountain backdrops characterize this geographic area. Pagosa Springs, the main urban center, is experiencing rapid growth. Due to the mix of private and public lands, the WUI is more extensive than in other places within the planning area. Residents value access and proximity to public lands. Consequently, the recreation use of the planning area close to Pagosa Springs is heavy and growing, while recreation public services are lagging.
Feedback from area residents	Agricultural roots are important in Pagosa, and many elements of the agricultural lifestyle relate to living near public lands. Some opportunities currently exist for recreation near Pagosa; however, many residents expressed the desire for more WUI recreational opportunities, services, and access. Scenery is very important to local residents and to the local economy. Pagosa residents like to recreate in the winter, and many go to the Wolf Creek Pass area, where the access to higher-elevation snow is easy and snow conditions are good.
Strongest recreation – tourism asset	Diverse opportunities for wilderness access offer diverse and high quality wildlife habitat.
Recreation – tourism economy	Unobstructed views of the San Juan Mountains are common from any of the thousands of home sites platted around Pagosa Springs. With up to 200 building permits per year, the Archuleta County development industry is accommodating the many new full- and part-time residents. The Wolf Creek ski area plays an important role in the otherwise quiet winter months, while the hunting season provides economic income to the area in the fall.
Management challenge	Managing hunting has been the biggest challenge for many years; however, this geographic area is changing from a rural forest to a residential intermixed forest. Management of recreation in the WUI, wilderness, and in relation to heritage tourism, would be the challenges of the future.

Table 3.14.3: Tourism Profile of the Columbine Geographic Area

Profile Component	Information
Terrain and access	The Columbine geographic area offers easier vehicle access to higher-elevation terrain than do either of the other two districts. This is via mining roads, timber roads, and state highways. The Columbine area offers almost limitless possibilities for recreation access along U.S. Highway 550, the San Juan Skyway. The area is also known for its wild country and big peaks. The scenery, and the strong presence of mountain adventurers of all types, reflects the proximity of some of the highest, most impressive, rugged mountains in Colorado.
Feedback from area residents	Residents seek high-quality recreation opportunities in the WUI and day trip opportunities to spectacular mountain settings. The easily accessible features of planning area near Durango, Bayfield, Vallecito, and other population centers are used frequently by the fitness-minded population of La Plata County. However, easy access to higher elevations entices recreational users out of the foothills and into the mountains for alpine day trips in winter and summer.
Strongest recreation – tourism asset	Easy road access to higher-elevation trailheads, cultural sites, and road-heads offers a remarkable range of recreation opportunities strongly connected to the communities of Durango and Silverton.

Profile Component	Information
Recreation – tourism economy	Durango has the longest history and most experience with tourism of any town in the region. Public land use reflects this experience and commitment to tourism with the Durango and Silverton Narrow Gauge Railroad, Animas River fishing and boating, two ski areas, world-class mountain biking, and the San Juan Skyway and Alpine Loop Scenic Byway.
Management challenge	This geographic area would continue to experience growth in population and tourism. Meeting the demand for a wide range of sustainable and diverse, developed and dispersed day-use recreational settings would be the biggest challenge.

Table 3.14.4: Tourism Profile of the Tres Rios Geographic Area

Profile Component	Information
Terrain and access	The Tres Rios geographic area has a wide variety of terrain and climatic zones, ranging from the high peaks in the mountains near Silverton, to the desert country along the lower Dolores River. Sagebrush steppe and pinyon/juniper ecotypes dominate the semiarid lands around the Dolores Canyon. Due to a long history of grazing and mineral extraction on these relatively flat mesas and foothills, road access to the northwestern parts of this area is extensive and well developed. The relatively flat topography of the semiarid areas also increases the impacts associated with OHV use.
Feedback from area residents	The local population in this far-western part of the planning area has a noticeably strong multiple-use ethic. A common sentiment expressed during the 2005 study group meeting held at the Dolores Public Lands Office was that the public lands in the area provide recreational opportunities for a wide variety of users. Many recognize the challenge of multiple uses; most, however, would prefer to avoid a high degree of use segregation. Many residents feel strongly about maintaining and not restricting OHV vehicle opportunities. With the exception of fairly widespread concern about gas well development, the majority of Tres Rios geographic area residents are tolerant, and even supportive, of traditional uses within the planning area.
Strongest recreation – tourism asset	Diversity of terrain and road access offers a variety of opportunities and disperses uses to many different areas.
Recreation – tourism economy	Mesa Verde National Park, hunting, and other traditional uses are the largest tourist attractions in the area. The proximity to the mountains goes hand-in-hand with the agricultural and rural lifestyles that many recent immigrants have come to enjoy in Cortez, Dolores, and other nearby communities. During infrequent dam releases from McPhee Reservoir, the Dolores River provides outstanding and remote rafting opportunities.
Management challenge	Travel management is the number one recreation challenge, and the designation of travel access routes would profoundly influence the recreation setting and experience in this geographic area.

Recreation Demographics and Demand Trends

The 2008 Colorado Statewide Comprehensive Outdoor Recreation Plan (State of Colorado 2008) provided information about people who visit state parks in southwest Colorado. In combination with NVUM survey results (2001) and information from Cordell et al. (1999), these data represent the general demographics of visitors to the planning area. Most visitors are white males over the age of 30 (with non-local residents being older, mostly over 45), with some college education and a middle-class income. More than 40% of visitors to the planning area are from local communities (including

Durango, Farmington, and Pagosa Springs). Wilderness visitors tend to be older than other visitors, with approximately 68% in the 40- to 70-year-old range.

Approximately 60% of visitors seek a setting that has little or no development or has limited trails, camping, boating, and fishing. Key activities for resident visitors include swimming and motorized boating. Non-resident visitors, on the other hand, plan to hike, fish, and camp. Most visitors indicated that “relaxing” and “spending time with family and friends” were their top reason for visiting.

Top primary activities were listed as viewing scenery, downhill skiing, hiking/walking, relaxation, and fishing. The most heavily used facilities include forest roads and trails. The most popular specially designated areas are the scenic byways and the wilderness areas.

Both tourism and regional populations are growing steadily due to the demand for an amenity-rich lifestyle, the centerpiece of which is the planning area. There is increasing participation in recreation activities that occur on public lands, particularly day-use dispersed recreation, motorized activities, and heritage tourism. The trend is a strong and steady increase in recreation demand, primarily driven by residents focused on public lands close to communities. In addition, there is a strong destination market driven by tourists who want to reconnect with rural communities within cultural landscapes.

Dispersed Recreation

The planning area offers an extraordinary variety of dispersed outdoor settings and opportunities, often defined by a low level of facility development, freedom of choice, and a semi-primitive and predominantly natural environment. A combination of features offers a remote, rustic, and primitive setting; high-quality scenery; and suitable terrain for camping, picnicking, mountain biking, OHV use, snowmobiling, backcountry skiing, hunting, and other dispersed uses. Users value the freedom of choice, remoteness, and naturalness associated with dispersed recreation use. Regardless of the activity, the opportunity to get away from day-to-day stresses and to be with friends and family in a natural setting is the primary benefit that motivate dispersed recreation visitors.

Traditionally used campsites are often clustered along streams in valley bottoms. Concerns have been raised regarding the sanitation, erosion, and wildlife impacts associated with heavily used, and easily accessed, dispersed recreation areas. La Plata Canyon, South Mineral, and Williams Creek are examples of locations with intensive dispersed camping use and with the associated wear and tear. Locations close to communities such as Cortez and Durango also show the impacts of constant and intensive dispersed day use. These issues and areas are addressed in Section 3.14, Recreation and are further described in Volume III, Appendix E.

Recreation Facilities and Funding

Within the planning area, only a fraction of the cost of providing recreation facilities and infrastructure is paid for by the annual revenues from all recreation fees (including special use fees, outfitter/guide fees, entrance fees, and recreation fees) collected.

The inventory of SJNF and TRFO recreation facilities includes campgrounds, picnic areas, trailheads, scenic overlooks, and marinas. Maintaining these facilities is costly. The SJNF and TRFO have identified maintenance backlogs and implemented a recreation facility master plan process designed to align recreation facility investments with benefits to visitors and available revenue. Implementation of the master plan would continue under all alternatives.

Demographic and recreation trends have important implications for the future of recreation facilities within the planning area. Aging populations from urban areas with more available leisure time, a predominance of day use versus overnight use, private/public partnership potential, the demand for heritage tourism, an “undeveloped” environment, “adventure learning” in “outdoor museum environments,” and the proximity of the planning area to growing communities are all facts that have important consequences for the appropriate location, type, and amount of future facilities and visitor services. Such considerations have helped guide the formation and implementation of the master plan.

Recreation Issues and Need for Changes

Historically, use of the planning area has emphasized commodities; however, current social, economic, and demographic changes have significantly increased recreational uses and have changed the nature of recreation demand. Recreation is now the most extensive and economically valuable resource associated with the planning area. Every recreation and leisure trend associated with public lands is reflected within the planning area (including amenity migration, baby boomer demands, wilderness area crowding, motorized recreation, WUI demands, and resort development). In contrast with the past, current management must accommodate and protect recreation values if it is to be successful and sustainable.

The recreation tourism market is expected to grow. Recent trends, as well as future projections, point toward increases in the number of participants, trips, and activity days for outdoor recreation across most activities. For many activities, participant growth would be faster than population growth.

Public land recreation sustainability has become dependent on a wide range of creative and effective partnerships that involve both public and private entities. The SJNF and TRFO must collaborate with commercial enterprise, land trusts, municipalities and state agencies, publishers, outfitter/guides, interpretive associations, and universities, among others. These partnerships would continue to bolster the SJNF and TRFO’s ability to effectively manage recreational uses within the planning area. Recreation within the planning area is a local, regional, and national resource. Collaborative efforts would directly affect the ability of the SJNF and TRFO to deliver sustainable recreation settings and benefits.

There are increasing concerns over access to the planning area, as well as regarding visual impacts to scenery. People who recreate within the planning area value scenery and expect a natural environment. They also value existing public lands access and are sensitive to changes in the location, amount, and type of access. The LRMP recognizes recreation as a primary product of the SJNF and TRFO, and this has helped guide decision-making throughout the planning process.

People are generally aware that every acre cannot support every type of recreation. They would like to maintain recreation opportunities and support multiple uses where it is feasible and sensible, while, at the same time, balancing use with recreation values. The range of alternatives offered in the LRMP/FEIS describes different combinations of actions intended to meet the stated emphasis of each alternative.

Recreation travel corridors are the backbone of recreational access to the planning area. These more developed routes serve as essential gateways to a wide range of recreational opportunities. Facilities along these corridors can further provide essential visitor services and serve as information hubs.

Nationally, motorized use of public lands has surged in the last few decades. Travel on scenic highways has doubled, and OHV use continues to grow as baby boomers age and become less

physically active. At the same time, the demand for “quiet” use in large remote backcountry areas is on the rise. The LRMP uses MAs and motorized travel suitability areas, among other management tools, to allow for each type of use that is in demand. Areas within the planning area are experiencing this increase, as well as its associated impacts on other users.

Dispersed use and day-use recreation is becoming a predominant recreation use within the planning area. Visitors and residents want quick access to public lands for short visits that are close to home (within a day’s drive) in a natural environment. The LRMP identifies several areas as SRMAs, assigns MA designations, and defines travel suitability areas as methods of managing this use long term.

Interpretation and conservation education is critical to stewardship of the planning area. Recent surveys show that the predominantly urban culture knows very little about public lands. Research indicates that people have a keen desire to participate meaningfully in land stewardship, as well as in the protection of their community’s public “backyard.” SJNF and TRFO managers can facilitate this involvement through continuing the partnership with the San Juan Mountains Association and working with other local interest groups. Such partnerships and conservation education programs would be maintained under all LRMP alternatives.

Colorado is known for its outdoor adventure sports. The planning area has long offered diverse outdoor recreational opportunities for all age groups and activity levels, as well as diverse recreational opportunities beyond adventure sports. Such diversity should continue to benefit the regional economy and allow the planning area to meet the anticipated demand from aging populations (who seek less active, close to home, outdoor recreation).

Heritage tourism, short loop trails, community connections, increased conservation educational offerings, day-use activities on trails and roads, and stewardship opportunities are all likely to offer a welcome complement to Colorado’s more traditional adventure sports.

Visitors are generally aware that every acre cannot support every type of recreation, however, maintaining recreation opportunities while supporting multiple uses can be seen as an optimal solution.

3.14.3 Environmental Consequences

General Impacts

Within the planning area, recreation occurs throughout the year. Various types of recreational opportunities, experiences, and settings would continue to be provided in various proportions under all of the alternatives. Within the planning area, recreation opportunities are managed according to their ROS setting, which are primitive, semi-primitive non-motorized, semi-primitive motorized, motorized, roaded natural, and rural. There are no urban settings within the planning area. Each alternative would propose different numbers of acres under the various settings and that, in turn, would change the social, physical, and administrative use of the setting.

In general, recreation opportunities available within each ROS setting would change to some degree between alternatives, and a large portion of the planning area would still be allocated to each ROS setting. Certain activities may be limited in geographic extent but would still be allowable, and other activities may have larger areas managed for that use. SRMAs would be established, but would not change recreational benefits, because the SRMAs are created to identify high-use areas and manage for the use patterns that have already been established within that SRMA boundary. Future

management actions may change emphasis on administrative activities; however, the recreational “niche” for the area would stay the same.

Recreation facilities would not be noticeably impacted in relation to any of the alternatives due, in part, to the long-term established use of these facilities, as well as their current capacity, the ability to handle increased occupation, and the considerable public investment in facility operation. Implementation of any of the alternatives would not impact the number and location of facilities. However, budget constraints and/or increases and use trends would result in a dramatic impact to facilities in the future and sites could be closed or decommissioned if adequate funding were not available. This would lead to a reduction in developed recreation opportunities within the planning area.

Allocation of land for potential ski area development on NFS lands (one of the allowable activities in MA 8) is considered a part of this planning process. Allocations made in the LRMP would not preclude the need for or consideration of future ski areas during the life of the LRMP. However, additional NEPA analysis for new ski areas (or the expansion of existing) into areas that are not allocated to such use in the LRMP would require a plan amendment in addition to project-specific NEPA analysis. All alternatives would continue the current permitted ski areas (e.g., Durango Mountain Resort and Silverton Mountain). Alternative D includes allocation of an area for expansion of the existing Wolf Creek ski area onto the SJNF. Wolf Creek ski area has been permitted long-term on the Rio Grande National Forest east of the Continental Divide, but if future development is approved within the allocated area, this would increase developed ski area acreage within the planning area. Alternative A would carry forward ski areas from the 1983 San Juan National Forest Land and Resource Management Plan. Alternative D would also keep the potential ski area in the East Fork of the San Juan River that was in the 1983 San Juan National Forest Land and Resource Management Plan. The East Fork ski area would impact the roadless character of the South San Juan Adjacent IRA and would increase commercial skiable terrain in the planning area (while, at the same time, non-commercial terrain would be lost).

The number of recreation residences would not vary by alternative. There are no other uses identified for the areas occupied by recreation residences. Future use is expected to continue to allow all recreation residences, and the SJNF and TRFO would continue to work in partnership with permit holders until conditions change or until the appropriate environmental analysis shows a higher need for these lands.

BLM WUI areas near Durango and Cortez would be designated as SRMAs under Alternatives B, C, and D, which recognizes the importance of the recreational values found in these areas. A specific Recreation Area Management Plan would then be developed for each new SRMA, which in general would lead to better management of access, recreation, and other resources within these areas, equating to a net positive impact to these areas in the long term.

Impacts Related to Travel and Access Management Decisions

Currently, travel and access is being affected by national policies adopted by both the BLM and the USFS. In the previous LRMPs, motorized recreation was open to cross-country travel unless closed or limited. The new policies change motorized recreation opportunities on roads, trails, and areas to “closed” unless designated as “limited” or “open.” The planning and environmental analyses for specific motorized route designations and the implementation of the landscape-level travel management plans are well beyond the scope of this LRMP (see Cumulative Effects analysis below). Following implementation of these travel management policies, in most cases summer motorized use would be limited to a system of designated routes, regardless of which action alternative is selected

for implementation. Efforts to minimize or resolve user conflicts is inherent in each of these travel planning efforts, so the LRMP is not intended to address or resolve specific travel management issues.

The following discussion therefore generalizes impacts per alternative and contrasts the relative impacts to user groups and recreational opportunities between alternatives. Although the travel management planning process would result in a motorized use map, it does consider the entire range of travel modes, from foot through motorized travel (including mountain bike and horseback use). Just as recreation use changes as population rates change within the planning area, so would travel use. Population in the planning area is predicted to increase; therefore, the demand for travel and access would also increase, regardless of alternative implemented.

Alternative A continues existing travel management and access, subject to the policies and landscape-level travel planning completed, underway, or planned throughout the SJNF and TRFO. Alternative C has the least acreage devoted to “suitable” for both categories of motorized use, with a proportional decrease in this type of recreational opportunity. Alternative D has the most acreage available for motorized uses, but this alternative would adversely affect non-motorized users in many of these areas.

Alternative B would do the most to minimize conflicts between winter sports users by directly avoiding contact between users and by maintaining settings consistent with achieving either motorized or non-motorized recreation benefits, rather than by default mixing the two. In general, non-motorized user experiences are adversely affected by concurrent motorized use, but not vice-versa. Therefore, it is important to have some highly desirable winter use areas that are closed to motorized use to allow for quality non-motorized user experiences. Alternatives B and C allow for this, but at the expense of winter motorized use opportunities in those areas. Alternative B allows for a balance of motorized and non-motorized oversnow travel to accommodate the needs of these sometimes polarized user groups. Advances in snow machine technology and capabilities have increased access to previously inaccessible (and often administratively closed) areas, necessitating some changes to area boundaries, particularly near primary highway mountain passes.

Similarly, for over-ground travel, Alternatives A and D would result in the greatest potential for user conflicts because they would offer the least area reserved solely for non-motorized forms of travel. These alternatives are therefore conducive to direct user conflicts such as motor vehicle noise, signs, and odors becoming (or remaining) prevalent in an area sought out for the benefits of quiet and primitive forms of recreation. Alternative C would minimize impacts to non-motorized recreational values in many areas, but at the expense of motorized use experiences in those same areas. Alternative B strikes a balance, with a considerable amount of opportunities available for both motorized and non-motorized uses, but with some areas set aside for quiet, primitive forms of recreation to reduce conflicts.

Generally, the alternatives would not differ in how they manage equestrian and mountain bike travel. User conflicts between motorized users, bicyclists, equestrian, or other non-motorized users that emerge on specific trails or land areas would be addressed in landscape-scale travel management planning. No SJNF and TRFO roads or trails currently available to the public would be designated as unsuitable for equestrian or bicycle travel under any of the alternatives.

Changes in recreation opportunities, in terms of allowing or limiting motorized use, would be most noticeable between alternatives where there are changes in the acreages allocated to MA 1 and 3 (Alternatives B, C, and D). Differences for travel suitability between the alternatives would be especially noteworthy in the areas of Hermosa Creek, Rico, Missionary Ridge, and Red Mountain

Pass. Alternative C would allocate the most land to a non-motorized setting (MA 1), Alternative B a lesser amount, and Alternatives A and D the least amount of non-motorized opportunities. Alternatives A, B, and D would offer more motorized access opportunities in both summer and winter when compared to Alternative C.

On BLM lands, the LRMP allocates land areas as open, closed, or limited to designated routes. Limited use areas are the predominant designation, and some areas are closed due to WSA status or other resource protection reasons. Alternatives B, C, and D all reduce overall OHV opportunities and access to some degree due to more closed/limited land allocations when compared to Alternative A. Alternative C has a slightly higher proportion of closed areas than the other alternatives, thus reducing OHV opportunities to some degree when compared to Alternatives A, B, and D. Open areas are very limited in all alternatives so there is no significant difference in impacts between alternatives due to open area designations.

Suitability for motorized travel during the summer months would be limited to designated routes over the entire planning area. Differences in motorized travel suitability recommendations between the alternatives, in terms of wheeled-travel experiences, would generally be subtle (see Volume III, Appendix V, Maps 20–23), as the overall proportion of acreages in each category does not change dramatically between them. Conversely, the long-term potential for maintaining the greatest amount of non-motorized recreation experiences would be highest under Alternative C, followed by Alternatives B, A, and D. Alternative C would have a profound impact on motorcycle experiences by closing several very popular single-track trails, including Calico and Hermosa Creek, to motorized over-ground use. (see Chapter 2 for acres of change by alternative.)

Winter motorized travel suitability recommendations have more differences between alternatives, and these differences would be important to user groups due to the inherent incompatibilities between motorized and non-motorized uses previously discussed in this section. Although some areas may become more prone to conflicts under Alternative B, this would be even more prevalent under Alternatives C and D due to their emphasis on non-motorized and motorized winter use, respectively. This would be due to users of all types vying for access and use of the same areas, particularly along the highway pass corridors. At the same time, motorized oversnow users would be displaced, in some cases, due to closures of areas to such uses, particularly under Alternative C.

Other increases in unsuitable acres between Alternatives A and B would result in impacts to motorized users (under Alternatives B, C, and D) by restricting vehicle use to designated routes within previously open areas. The action alternatives also add acreage as unsuitable within administratively closed areas such as congressionally designated wilderness areas, the Piedra Area, and WSAs and RNAs. In total, these areas account for approximately 536,292 acres (approximately 23%) of the planning area under all of the alternatives.

The alternatives would address oversnow travel in different ways (see Volume III, Appendix V, Maps 24–27). Alternative A would offer the current opportunities, without resolving any of the conflicts between motorized and non-motorized winter use. These areas are typically along major highways near passes, such as Lizard Head, Molas, and Wolf Creek passes. Alternative B would present a mix that would keep the number of suitable acres for both motorized and non-motorized recreation balanced (but would make changes in where use would be allowed). Alternative C would increase the amount of non-motorized suitable acres, while Alternative D would propose a larger amount of motorized suitable acres. Alternatives B and C seek to reduce conflicts by allowing only non-motorized use in some key areas, reducing direct user conflicts yet still allowing motorized use in the same landscape with access from the highways.

The alternatives differ in the way they would address winter motorized and non-motorized user conflicts, especially in areas with consistent snow (including Molas Pass, Rico, Red Mountain Pass, Hermosa Creek, Missionary Ridge, and Vallecito Reservoir).

Alternative C would make most of the acreage in these areas unsuitable for motorized oversnow travel, while Alternatives A and D would do the opposite (proposing the highest amount of oversnow motorized suitable acreage, especially in the Rico and Red Mountain areas).

Oversnow motorized use is expected to take place on both groomed trails and cross-country where allowed, and none of the groomed trails are considered for closure under any of the alternatives. Some oversnow motorized users (particularly intermediate and advanced users) would experience a loss of some use under Alternatives B, C, and D, due to identification of some back-country areas as unsuitable for oversnow motorized use as shown on Maps 24 through 27 (Volume III, Appendix V). Conversely, non-motorized oversnow users (particularly intermediate and advanced users) would have additional areas along major roads that provide access to ungroomed backcountry winter play areas under Alternatives B and C. See Chapter 2 for acres of change by alternative.

The following site-specific examples show the differences between alternatives.

Dolores Canyon Overlook: Routes along county roads accessing BLM-administered lands, and up to the Dolores Canyon Overlook, would be considered suitable under Alternatives B and D. The area would be open to snowmobiling under Alternative A and closed under Alternative C. Motorized use and experience is not expected to change between Alternatives A, B, and D, and motorized use would be eliminated under Alternative C. This would result in users looking for a motorized oversnow experience moving to other areas where that activity is allowed.

Lizard Head Pass: The groomed route up Barlow Pass and the area east of Lizard Head Pass up to the divide between Dolores and Columbine Ranger Districts would be considered suitable under Alternatives A, B, and D. Under Alternative C, only the groomed route up Barlow Pass (down the East Fork of Hermosa Creek) would be suitable. There would be opportunities for hybrid skiing (which uses snowmobiles to tow skiers up the slopes) and backcountry skiing; however, off-route snowmobiling would be prohibited.

Red Mountain Pass: Under Alternative A, both sides of U.S. Highway 550 would be open to oversnow motorized use, leading to potential conflicts between motorized users and non-motorized users (e.g., skiers, snowshoers). Under Alternative B, the west side of U.S. Highway 550 (up to the San Miguel County line) would be suitable; however, the east side of U.S. Highway 550 would be unsuitable to motorized use (but open to backcountry skiing). Under Alternative C, both sides of U.S. Highway 550 would be unsuitable for motorized use (but open to backcountry skiing). Under Alternative D, the west side of U.S. Highway 550 would be suitable for motorized use, and the east side of Forest Road 850, as well as the ridge north to McMillan Peak into Prospect Gulch (including Minnehaha Basin) would be suitable for oversnow motorized travel. The areas south of McMillan Peak, east of U.S. Highway 550 and west of CO 110 (Cement Mountain Road) would be unsuitable.

Under Alternatives A and D, Red Mountain Pass would be open to motorized oversnow travel on both sides of U.S. Highway 550. In the past, such an arrangement has resulted in an increase in conflict between motorized and non-motorized users. Both motorized and non-motorized users are accessing this area to experience the easily accessed and outstanding alpine scenery. Under these alternatives, oversnow motorized users would share terrain with non-motorized users, and it is likely that the backcountry skiing community would not have a positive experience due to having snowmobiles in the area. Adverse impacts to skiers' experiences are typically due to snow compaction, noise, and

perceived or actual interpersonal conflicts. Under Alternatives B, C, and to a lesser extent D, snowmobiling opportunities would be lost, and oversnow motorized users would be displaced.

Molas Pass: Under Alternative A, the 200 acres east of U.S. Highway 550 (around Andrews Lake) would remain unsuitable for motorized use, and the rest of the area that is currently suitable for motorized use would remain suitable. Alternative B would make the area south of Big Molas Lake, as well as east of U.S. Highway 550 down to Lime Creek, unsuitable, and the area west of U.S. Highway 550 to West Lime Creek ridge north toward Grand Turk suitable. The boundary changes on the west side of U.S. Highway 550 would open some new terrain to snow machines, but this area is difficult to access and would primarily serve expert sports users' needs until tracks were broken in and/or the snowpack had consolidated in late winter.

Overall, Alternative C would result in the greatest impacts on motorized recreation opportunities, followed by Alternatives B, D, and A, respectively. In general, travel access and management allocations under Alternative C would result in the greatest benefits to non-motorized recreation (by allocating the most land to those uses and reducing the potential for user conflict), followed by Alternative B and then Alternatives D and A.

Recreation Opportunity Spectrum

The ROS maps found in Volume III, Appendix V (Maps 28–35) were developed to serve as a guide indicating what, in the managing agencies' best estimation, are the most appropriate recreational use types and experiences for each area of the public lands. The ROS zones vary between each alternative to reflect the overall theme for each alternative as discussed in detail in Chapter 2 of this FEIS. The ROS concept is not to be confused with actual land allocations, such as the MAs on SJNF lands, although efforts were made to ensure ROS zones and MA designations were compatible through the planning process.

Impacts Related to Oil and Gas Leasing Decisions

In general, the act of leasing public lands for oil and gas development would have little impact on individual recreation experience. Impacts to recreation would occur when oil and gas development under the leases actually begins, not as a direct result of lands being found suitable for oil and gas leasing in this LRMP.

Paradox Basin (USFS): The USFS portion of the Paradox Basin is not currently developed for oil or gas. The anticipated 140 new wells that would be constructed in the area would be accessed by existing roads or by short spur roads constructed in this moderately roaded landscape. NFS lands in the Paradox Basin portion of the RFD area are almost one-half (approximately 47%) roaded natural (ROS) setting and show evidence of a multiple-use emphasis. Another one-third of the area (approximately 31%) is in the semi-primitive (ROS) setting (there are no wilderness areas in the USFS portion of the Paradox Basin). One-fifth (approximately 22%) of the area is in the rural setting (ROS) (primarily around McPhee Reservoir, the Dolores River, and above the town of Dolores). Considering existing use types and levels, the terrain, and the recreational experiences available elsewhere in the San Juan Mountains, adverse impacts of oil and gas development in the Paradox Basin area on recreational experiences are expected to be minimal.

San Juan/San Miguel (USFS): Within the San Juan Sag area, there have been exploratory wells drilled at an average rate of one well every 3 years, mostly using existing roads. The wells have all been plugged and abandoned, and the sites have been reclaimed. Existing development has had little, if any, impact on dispersed recreation. Future oil and gas development within the area is

projected at two wells per year for a period of 10 to 15 years. These wells, similar to past wells, would mostly utilize the existing road system; however, some spur roads would be constructed. Construction activities would introduce noise, dust, and construction traffic. Impacts related to construction activities would be short term and minor. Long-term impacts would depend on the success of continued exploratory activities; however, the anticipated low rate of development would not measurably impact the current dispersed recreation patterns of use (which are mostly driving forest roads for pleasure, firewood gathering, and hunting).

Lands in the San Juan Sag portion of the RFD area would be over one-half (approximately 6%) roaded natural (ROS) settings, primarily along travel corridors and areas showing evidence of a multiple-use emphasis. Another one-quarter of the area (approximately 24%) would be in the semi-primitive (ROS) setting. The remaining 8% would be in the rural (ROS) setting, around the town of Pagosa Springs.

Direct and Indirect Effects

Recreational impacts may occur over the life of the projected oil and gas development. Specifically, recreation impacts could include:

- Oil and gas development altering the natural setting and visual character of an area used for recreation;
- Oil and gas–related construction, operation, and maintenance disrupting recreation as a result of noise, dust, traffic, and increased human activity; and
- Oil and gas development that may not be compatible with federal, state, or county objectives for recreation in portions of the planning area.

The areas with highest oil and gas potential (e.g., Paradox Basin) toward the west side of the planning area do differ in character from most other parts of the SJNF and TRFO. The areas' drier climate, relatively lower elevation, more arid vegetation types, and more open terrain lend the areas to different types of summer and winter recreation when compared to the eastern portions of the SJNF and TRFO.

Summer recreation that may be impacted by oil and gas leasing and development in the SJNF and TRFO includes viewing (natural feature, wildlife, historic/prehistoric sites), OHV use, mountain biking, hunting, and to a lesser extent hiking, driving for pleasure, camping/picnicking, and fishing. Numerous four-wheel-drive roads and trails traverse the areas of prospective oil and gas development and offer opportunities for dispersed activities. If areas are made available for lease, oil and gas development in the SJNF and TRFO could affect recreation settings and participation in these recreational pursuits.

Impacted winter activities could include cross-country skiing, snowshoeing, and snowmobiling although snow cover is often inadequate or too fleeting in nature to allow these activities in the areas with the highest oil and gas development potential mentioned above.

Due to the standard operating procedures, stipulations, and other permitting requirements incumbent upon any new oil or gas well development, there are similarities in the impacts associated with each well developed, although the total number of wells that could be developed varies, in some cases significantly, between alternatives (e.g., Alternatives C and D). Existing recreational uses in high oil and gas potential areas tend to be of a dispersed, motorized nature, and areas of wells could be avoided during recreational activities.

The following leasing stipulations would apply to management of recreation areas and opportunities (Table 3.14.5). NSO stipulations are prescribed to avoid areas where the construction of oil and gas facilities is considered not compatible with recreation, such as protection of viewsheds along major recreation corridors, developed recreation sites, and ski areas. CSU stipulations apply to SRMAs (BLM) to mitigate impacts to high use recreation areas.

Table 3.14.5: Lease Stipulations for Recreation and Scenery by Alternative

Recreation and Scenery	Alternative A	Alternative B	Alternative C	Alternative D
Developed administrative and recreation sites: Within 0.25 mile around developed administrative and/or recreation sites.	NSO	NSO	NSO	NSO
Developed administrative and recreation sites: Surface use or occupancy would be prohibited unless or until the operator demonstrates that operations can be acceptably conducted within 1 mile of developed administrative and recreation sites.	NSO	CSU	NSO	SLT
SRMAs (BLM): Durango, Dolores River Canyon, Silverton, and Cortez.	SLT	CSU	CSU	SLT
National scenic byways, All American roads and backcountry byways; designated scenic trails, recreation, and historic trails; and recreation-emphasis corridors: Within the identified foreground viewshed, up to 0.5 mile on either side of the following: San Juan Skyway, Trail of the Ancients, the Alpine Loop Back Country Byway, Old Spanish Trail, Continental Divide Trail, Colorado Trail, Calico Trail, Highline Loop Trail, East Fork Road, West Fork Road, First Notch Road, Piedra Road, Poison Park Road, Lime Creek Road, South Mineral Road, La Plata Canyon Road, West Dolores Road, and Durango-Silverton Narrow Gauge Railroad.	CSU/NSO	NSO	NSO	CSU
Old Spanish Trail: No surface-disturbing activities up to 0.5 mile of either side of the centerline of the congressionally designated trail in high potential segments.	SLT	NSO 0.5 mile	NSO 5 miles	NSO 0.5 mile
Old Spanish Trail-Visual: CSU for the horizon on either side of the centerline of the congressionally designated trail in high potential segments.	SLT	CSU	CSU	SLT
High SIO and VRM Class II areas	CSU	NSO	NSO	SLT

CSU stipulations are more flexible in terms of ability to mitigate impacts, allowing greater latitude to relocate access roads and drilling sites in the SJNF and TRFO to minimize impacts to the natural character of the environment. The stipulation’s flexibility, as prescribed in leasing Alternatives B and C, may be better suited to maintaining opportunities for semi-primitive non-motorized and motorized settings.

An NSO stipulation is also used to mitigate potential impacts to facilities, the recreation experience and safety of users, and the natural environment that initially made a developed site, special area, or travel corridor desirable for the existing use. Access roads would be located outside developed site buffer zones unless alternative routes would be more damaging to the environment. NSO buffer

zones along travel corridors would allow limited occupancy for roads and utility transmission facilities if they could be constructed without significantly affecting the values the buffer zone was designed to protect.

Making recreation areas, particularly currently undeveloped areas and special management areas, administratively not available would protect these areas from direct impacts of potential development activity, as does an NSO stipulation. The use of administratively not available decision where NSO could provide the same protection may be more restrictive than necessary.

The Dolores River Canyon is assigned an NSO stipulation within and up to 0.25 mile of the canyon's boundary to protect the natural character and the areas wilderness characteristics, as well as recreational and scenic values. This stipulation does not vary by alternative because it is thought that standard lease terms or CSU cannot protect the outstanding values of an area of this size.

Alternative Comparison: Alternatives A, B, and D have similar projected levels of oil and gas development and, therefore, would create similar impacts to recreation settings and activities. The lease stipulations prescribed above should eliminate many development conflicts, particularly in scenic corridors and developed sites, and in other cases would provide for more flexibility to advantageously site oil and gas facilities, reducing potential recreation conflicts. Alternative D would have the least protective stipulations, potentially resulting in the greatest recreation conflicts among the alternatives.

The No Leasing Alternative would still result in development of existing leases, but there would be an approximate 50% reduction in projected oil and gas development and impacts in the Paradox Basin public lands. Oil and gas impacts would be confined to the northern portions of the area of prospective development.

Under standard lease terms prescribed in Alternatives A and D, there is a higher degree of risk that the limitations of permissible constraints would not be sufficient to meet management guidelines. For example, in areas managed for semi-primitive setting and recreation, the limitations on moving facilities under the restriction of standard lease terms may not be adequate to ensure that road systems are located away from dispersed recreation sites or backcountry trails. In areas managed for roaded natural opportunities, standard lease terms may also pose risks that activities cannot be located away from scenic corridors and developed sites.

SRMAs are assigned CSU in Alternatives B and C. SRMAs are landscapes identified by the agency and public to manage the areas primarily for the quality and sustainability of the recreation experience. The CSU stipulation provides more flexibility than standard lease terms to move facilities to best achieve natural screening. The CSU also serves as a notice to the lessee that additional planning and mitigation would be necessary before surface-disturbing activities take place. The standard lease terms utilized in Alternative A do not provide the siting flexibility provided by the CSU stipulation.

NSO would be permitted within the identified foreground viewshed, up to 0.5 mile on either side of a number of heavily used national scenic byways, All American Roads, and backcountry byways; designated scenic, recreation, and historic trails; and recreation-emphasis corridors. The NSO stipulation is considered necessary to protect the integrity of viewsheds in scenic and cultural landscapes along significant, special routes and popular scenic drives. If CSU is utilized for the same routes, there may be higher risk of the auditory and visual impacts of oil and gas development within proximity to those routes. The visible evidence of oil and gas development is inconsistent with the maintenance of high scenic integrity in the foreground of these routes.

Guidelines for recreation resource management are listed in the LRMP, Volume II. Additional management direction below is contained in the laws, regulations, policies, and handbooks that guide recreation management of the SJNF. The stipulations, standards and guidelines, and below referenced direction present the basis for management of potential conflicts between oil and gas development and recreational pursuits.

Impacts on Dispersed Recreation

As a result of oil and gas development and its visual impacts, there may be a reduction in the number of visitors to developed lease areas in the SJNF and TRFO who drive for pleasure or engage in other recreational activities such as viewing scenery, hiking, camping, hunting, and mountain biking. To a lesser degree, the number of winter recreationists may decrease due to a reduction in visual quality and extensive snowplowing that would accompany the operation of an oil or gas field. The intent of the stipulations is to mitigate impacts to recreation and thereby meet the goals and objectives in the LRMP. There are significant portions of the SJNF and TRFO where oil and gas development would be more compatible with LRMP multiple use objectives and would, therefore, be managed under CSU or standard lease terms. These are generally areas that have fully developed road systems as a result of active management activities, including timber management and past and current oil and gas development.

SJNF and TRFO lands are mostly roaded, reflecting a history of multiple use management. The NFS portion of the Paradox Basin has minor oil and gas development, but portions of the BLM lands are more heavily developed. The anticipated 660 well pads constructed on new leases in the SJNF and TRFO (375 on existing leases) would be accessed by existing roads and by constructing short spur roads off the existing road system. The spur roads would not add motorized recreation opportunities, being closed to public motorized access.

Impacts on Developed Recreation

Recreation facilities in the SJNF and TRFO include campgrounds, picnic sites, trailheads, boating sites, fishing sites, and interpretive sites. A lease stipulation applied in all alternatives requires NSO within 0.25 mile of developed recreation sites. The sounds and sights of well construction could impact campgrounds but would be short term in duration. Each well would be drilled and completed over a 2- to 6-week period, then construction impacts would cease and production activities would begin. The 0.25-mile buffer would reduce or eliminate the sounds of producing wells, and wells would be located, where possible, to eliminate direct sight lines to developed recreation facilities. Some sounds could still be audible from recreation sites and audible to dispersed recreation users during maintenance activities and more consistently from compressor station motors.

Impacts Related to Fire and Fuels Management Decisions

Under all of the alternatives, fuels treatments would be similar. Impacts to recreation would be mitigated, primarily because the activities would be short-term disruptions of the experience to the users that would be mitigated through guidelines applied to the project and implemented while the treatments are taking place. Impacts within SRMAs may be somewhat greater due to the concentrated use in these areas. However, impacts would be adequately mitigated by applicable guidelines and any land use restrictions specific to the project area. It would be difficult to specifically determine impacts to recreation experiences due to fire and fuels activity, but it is reasonable to assume that such impacts would be related primarily to the change in appearance to the visual recreation setting. Some displacement or other inconvenience to recreational users may be realized on occasion due to temporary closures put in place during project work.

The impacts related to fire and fuels management on recreation would be similar under all of the alternatives. In addition, recreation facilities, SRMAs, national trails, and scenic byways have already included measures to protect recreation experiences, such as minimum impact suppression tactics in these areas and limitations on motorized equipment use (e.g., bulldozers), among others.

Impacts Related to Timber Management Decisions

Under all of the alternatives, impacts to recreational settings (ROS) related to timber management would remain unchanged, as all of the alternatives include standards and guidelines related to timber harvest that are intended to minimize adverse impacts to many resources, including recreation. Impacts are also reduced since less than 50% of the planning area is classified as suitable for timber production, and timber harvest volumes have been on a steady decline over time (see Section 3.9).

Site-specific impacts to recreation would be minor and primarily short-term disruptions of the experience to the users that would be mitigated through guidelines applied to the project and implemented while the activity is taking place. Impacts due to harvest activities within SRMAs would be moderate because of the concentrated use and interest in these areas; however, such projects would again be mitigated by guidelines specific to MA allocations. BLM SRMAs are required to have area-specific management plans developed, which would include specific guidance on mitigation measures or other project restrictions regarding timber management activities. The addition of new roads may eventually provide some additional opportunities for recreational access once the timber treatment is completed. However, most of the proposed new roads would be in areas that already have extensive road systems and the roads would not be open to public use and/or would be decommissioned when the project was completed; therefore, the impacts would be negligible.

Impacts Related to Minerals Management Decisions

Under all of the alternatives, impacts to recreational settings (ROS) related to minerals management would remain unchanged. Impacts to the recreation setting would be from the long-term disturbance to the area. Users would tend to move from these areas in order to have the experience they desire while the minerals activity is taking place. Given that most of the future mineral activity would take place in areas of former activity, the amount of projected acres for development disruption to recreation experience would be minor.

The impacts related to minerals development on recreation would be similar under all of the alternatives because future minerals development would be subject to standard operating procedures and permitting processes, and demand for development in new areas is expected to be low due to low mineral potential.

Cumulative Impacts

In addition to trends described at the beginning of this section, the cumulative impacts described below include historic, current, and reasonably foreseeable future activities that were considered with regard to recreation. The next 15 years are considered the timeframe for reasonably foreseeable future cumulative impacts.

Planning Area Recreation Setting Shift: Historic project-level decisions (primarily oil and gas development, timber management, and road construction for access to private in-holdings) in the planning area have resulted in a shift in area-wide recreation setting composition, from the semi-primitive non-motorized and semi-primitive motorized to the more developed roaded natural and rural (ROS) settings. This has been a long-term trend and one that is likely to continue due to population

increase within the planning area and increasing development and road building adjacent to public land boundaries.

As discussed in the general impacts portion of this section, the existing planning area recreation setting composition would experience the least amount of shift under Alternative B, followed by Alternatives C, D, and A, respectively. Alternative B would result in the greatest potential, over the long term, for loss of remote/wilderness setting. This is due to the differing level of management activities (especially private land in-holding development, oil and gas, timber and fire/fuels management, and associated road construction) that may take place under the various alternatives. As private development continues to encroach upon public land boundaries, recreational use for those seeking primitive experiences would likely shift to more remote and difficult to access areas. However, increased WUI use can be expected as local residents access adjacent public lands from their properties or subdivision property.

Future Off-trail Travel ("open areas"): Currently, travel and access is being affected by a major policy shift on a national basis. This paradigm shift (from open unless closed, to closed unless open) is intended to reduce adverse resource impacts related to motorized recreation nationwide. The alternatives allow for motorized use under these policies, but cross-country travel is extremely limited in the planning area. This would likely reduce long-term adverse impacts due to motorized use. Under this new USFS policy (2005), summer motorized use would be restricted to designated routes, regardless of which alternative is selected for implementation. BLM Handbook (H-1601-1) requires all motorized travel to be classified as open, limited, or closed to motorized travel activities.

Future Oversnow Travel: Winter recreation has been affected in recent years by the increase in population in southwest Colorado, which has resulted in increased competition for access to recreational opportunities on snow. In addition, snowmobiles have increased in power and reliability, which has allowed more terrain to be used. Backcountry skiers also have better equipment, and there has been an overall surge in adventure skiing. During the past several decades, backcountry skiers and snowmobilers have worked out their differences where individuals would have winter recreation experiences. For the most part individuals, clubs, and communities worked out which areas were available for motorized and non-motorized use. This cooperation has been challenged by the increase in users, as well as by changes in technology.

Oil and Gas Development Implications: The majority of development would continue in existing fields. The most noticeable exception is estimated at 125 new wells, with an associated 425 acres of disturbance on NFS lands in the Paradox Basin. Under the No Leasing Alternative this development would not take place. Additional CBM development in the NSJB on both NFS and BLM lands would continue to take place regardless of new leasing or no leasing scenarios. In its November 2006 FEIS regarding the NSJB-CBM project, the SJNF and TRFO arrived at several conclusions with regard to cumulative effects that are pertinent to consider within the framework of recreation implications for the planning area. The development scenario in the San Juan Sag is estimated at between two and seven wells with 50 acres of disturbance that would be reduced to only two exploratory wells under the No Leasing Alternative. Although future development would likely occur under all alternatives, cumulative effects on recreation are not expected to be significant due to the small scale of future disturbance.

The broader cumulative effects analysis area includes areas where oil and gas development has occurred and would continue to take place on private mineral estate adjacent to public lands in the Paradox Basin portion of the planning area. Most of the private lands are not high use recreation areas but serve as gateways to public lands. The additional development on private lands would require pads and access roads, and would generally result in the environmental impacts described

above. New oil and gas wells would add an industrial component to the landscape and introduce new sources of vehicle traffic and noise that would diminish the natural setting sought by most recreationists. Oil and gas–related construction, operation, and maintenance could also disrupt recreation and tourism as a result of noise, dust, traffic, and increased human activity. Some of the limited recreational and tourism activities that take place on private lands, such as hunting, could be displaced to the public lands.

Colorado State OHV Program: Currently all OHVs (ATVs, dirt bikes, and other unlicensed OHVs) are required to display a Colorado OHV permit while operating on public lands, as well as on other designated trails and areas (mirroring the current snowmobile registration requirements). Just as snowmobile use has increased dramatically since the 1990s, OHV use would likely continue to increase due to increased information and advertising by the State Division of Tourism. Potential adverse impacts that may be anticipated as a result of greater information/promotion would include additional users at trailhead facilities, as well as more encounters on open roads and trails (which may increase the perception of crowding).

3.15 Scenery and Visual Resource Management

3.15.1 Introduction

Private development and population continue to increase within the planning area, as do the demands on area resources. Concerns about retention of the area's outstanding scenic quality are at the forefront of public interest on the SJNF and TRFO. Visitors and residents alike place a high value on the protection of intact natural and cultural landscapes. The economic and lifestyle benefits of high quality scenery are primary contributors to the wealth of the region.

Legal and Administrative Framework

Laws

- **The National Environmental Policy Act of January 1, 1970:** NEPA states that it is the "continuing responsibility of the Federal government to use all practicable means to assure for all Americans, aesthetically and culturally pleasing surroundings." NEPA mandates agencies to develop methodologies for scenery management of "aesthetically and culturally pleasing surroundings" that are capable of being put into practice. NEPA requires "a systematic and interdisciplinary approach, which will ensure the integrated use of the natural and social sciences and the environmental design arts into planning and decision-making which may have an impact on man's environment."
- **The Multiple-Use Sustained-Yield Act of 1960:** Under this act, "National forests are established and shall be used for outdoor recreation, range, timber, watershed, and wildlife and fish purposes." The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple uses and sustained yield, without impairment of the productivity of the land.
- **The Federal Land Policy and Management Act of 1976:** FLPMA states, "…public lands will be managed in a manner which will protect the quality of the scenic (visual) values of these lands."

SIOs for NFS lands are identified on a map that was developed as part of the 1983 San Juan National Forest Land and Resource Management Plan. This information is displayed as Alternative A in this FEIS.

Scenic quality objectives for BLM lands were not identified as part of the 1985 San Juan/San Miguel Resource Management Plan. The RMP states that visual resource objectives would be developed on a project specific basis. BLM policy outlines a process to identify interim VRM classes for each project. Consequently VRM classes for BLM lands in Alternative A are not shown in this FEIS.

Management of Scenic Values on NFS Lands: On NFS lands, scenic integrity levels are used to assess current scenic conditions and the potential impacts under the alternatives. These scenic integrity levels are determined by mapping the following:

- Dominant landscape characteristics;
- Scenic attractiveness;
- Constituent information and concern levels; and
- Distance zones - Immediate foreground, foreground, middle ground, background, and unseen.

Scenic integrity levels are used to measure the human-caused disturbance that deviates from the dominant valued attributes of the landscape character. These levels are used to compare the impacts between the alternatives. The scenic integrity levels are:

- **Very High Scenic Integrity Level** – This refers to landscapes where the valued landscape character is intact with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level.
- **High Scenic Integrity Level** – This refers to landscapes where the valued landscape character appears intact. Deviations may be present; however, they must repeat the form, line, color, texture, and pattern common to the landscape character so completely, and at such a scale, that they are not evident.
- **Moderate Scenic Integrity Level** – This refers to landscapes where the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low Scenic Integrity Level** – This refers to landscape where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed; however, they borrow valued attributes (including size, shape, edge effect, and pattern of natural openings), vegetative type changes, and/or architectural styles outside the landscape being viewed. These should appear as valued character outside the landscape being viewed, and should be compatible or complimentary to the character within.
- **Very Low Scenic Integrity Level** – This refers to landscapes where the valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes (including size, shape, edge effect, and pattern of natural openings), vegetative type changes, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the compositions.

Scenic integrity objectives are then developed based, in part, on the scenic integrity levels but may also be determined by other resource allocations and uses as analyzed in the land use planning process. The five scenic integrity objectives are as follows:

- **Very High** – Human-caused change to the landscape is not noticeable.

- **High** – Landscape may not be substantially altered by management and other activities.
- **Moderate** – Landscape may be slightly and noticeably altered by management and other activities.
- **Low** – Landscape may be moderately altered by management and other activities.
- **Very Low** – Landscape may be heavily altered by resource management and other activities.

VRM on BLM Lands: VRI classes are assigned to land units based on scenic quality, sensitivity level, and distance zones. The VRI for the public lands serves, in part, as the basis for the VRM class determinations, although other resource allocation decisions are also considered when designating VRM classes. However, the BLM is not required to assign a VRM class that mirrors the VRI findings if other resources and/or issues dictate a different VRM class.

A VRM class is based on the degree of acceptable visual change within that landscape, which may factor the physical and sociological characteristics of any given homogeneous area, and serves as a management objective. Each class has an objective, which prescribes the amount of change allowed in the characteristic landscape. The VRM classes are:

- **Class I – Objective:** Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
- **Class II – Objective:** Retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- **Class III – Objective:** Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- **Class IV – Objective:** Provide for management activities that require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

Scenic Stability (SJNF only): Scenic stability is a measure of the degree to which the ecosystem is able to restore, maintain, or continue to exhibit the positive scenic attributes of the landscape. The levels of scenic stability are:

- **High** – High scenic stability is a condition within which the positive scenic attributes of an area are expected to be perpetuated.
- **Low** – Low scenic stability is a condition that puts scenic values in jeopardy of being lost (e.g., catastrophic wildfire).

Narrative Description of Scenic Character: This indicator describes what the general forest would look like to the visitor in the short and long term. The narrative describes the dominant landscape character attributes and the impacts to scenery due to management activities and the built environment.

MAs and ROS Settings: These two indicators are important because they determine a substantial part of the physical setting that is important to recreating visitors. In general, ROS zones and MA classes should be compatible with an area's VRM/SIO. Recognizing the interdependency and interrelationship of these three zoning concepts and balancing their individual intents and desired conditions is a key component of the LRMP process.

Rehabilitation is a key element and management prescription used both long and short term to restore landscapes containing undesirable visual impacts to a desired scenic quality. It may not always be possible to achieve the prescribed SIO/VRM standard with rehabilitation immediately, but it may help to create a more visually desirable landscape in the interim. Economic feasibility would help determine the amount and location of rehabilitation during project level analysis. Rehabilitation may include:

- Vegetation management to eliminate unnatural edges, shapes, patterns, and colors;
- Alteration, concealment, or removal of structures containing unnatural forms, colors, or light reflections; and
- Alteration, concealment, or removal of slash construction debris.

3.15.2 Affected Environment

Existing Conditions and Trends

The planning area encompasses extraordinary scenic resources, including the San Juan Skyway, three national scenic and recreation trails, the Colorado Trail, segments of eligible WSRs, Colorado's largest designated wilderness area, the spectacular Dolores River Canyon, and three cultural landscapes (McPhee, Chimney Rock, and Silverton). The planning area is known for its picturesque groves of aspen and ponderosa pine. Large reservoirs (McPhee, Lemon, Vallecito, and Haviland) and scenic river corridors (including the San Juan, Animas, Dolores, Piedra, and Hermosa Creek) provide water-based recreation settings that are in great demand in the Southwest.

Tourism that is substantially dependent on scenery and heritage resources is an economic mainstay of southwest Colorado. People often come to live in the communities surrounding the planning area in order to benefit from the public land opportunities and amenities found on the nearby public lands.

The National Survey on Recreation and the Environment surveyed 60,000 households in the United States. More than 86% of respondents said "managing forests to leave them natural looking" was important or very important. In 1997, approximately 1.037 million sightseeing excursions were made to national forests, and 671 million people participated in wildlife viewing (Cordell 1999).

According to America's Byways Resource Center (2004), the total vehicle miles traveled on the San Juan Skyway nearly doubled from approximately 700,000 daily vehicle miles traveled in 1990 to more than 1.2 million daily vehicle miles traveled in 2002. The same report concluded that 54% of all travelers on the San Juan Skyway are traveling just to drive the skyway, with no particular destination.

Interviews with people who recreate within the planning area found that nearly everyone made reference to the core value of a pristine natural environment as one of the primary reasons they choose to recreate on public lands (Rural Planning Institute 2004).

According to the 2001 NVUM project conducted in the planning area, viewing scenery was the most popular activity, with a 68% participation rate (NVUM 2001).

NFS lands are rated via scenic integrity level evaluations, while BLM lands are assessed via a VRI process. Many of the landscapes in the planning with these ratings have very high visibility and contain high-quality scenery that includes dramatic landscapes with mountains, water, and forests.

An additional indicator of scenic value is the visibility of the landscape. In scenery and visual resource analysis, visibility assesses how much access visitors have to view a given area's scenery on roads, trails, and at recreation sites, as well as how concerned they are about that scenery. The planning area has a landscape with very high visibility and also has visitors with a high concern for scenic quality. Nearly half of the planning area is in the foreground viewshed of a constituency that cares about high-quality scenery.

The current condition of visual resources within the SJNF and TRFO is shown in Table 3.15.1. The table shows that 56% of NFS lands retain very high or high scenic integrity, with the remaining 44% in the moderate or low/very low integrity classes. BLM-administered lands have 24% in the very high or high VRI classes, and 76% in the moderate to low VRI classes.

Table 3.15.1: Existing Scenic and Visual Resource Condition, Percent of Total Area

Existing Scenic and Visual Resource Condition	Very High Integrity; VRI/VRM Class I	High Integrity; VRI/VRM Class II	Moderate Integrity; VRI/VRM Class III	Low/Very Low Integrity; VRI/VRM Class IV
NFS lands	22%	34%	38%	6%
BLM lands	0%	24%	21%	55%

The table above indicates that within the planning area, management activities have altered the natural landscape character to a moderate degree on about 50% of the planning area as shown in the last two columns of Table 3.15.1. The most visible impacts have most often resulted from energy development, mining, and past timber harvesting activity.

Scenic Stability (San Juan National Forest only)

Scenery is dependent on a healthy ecosystem. Natural disturbance elements (including fire, flood, landslides, and avalanches) are normal ecosystem processes and create or perpetuate natural scenic conditions. In particular, wildfire is a disturbance factor that has been profoundly affected by fire suppression and other land management activities.

Current conditions in aspen and ponderosa forests place scenic quality in jeopardy because of a lack of age-class diversity, the encroachment of shade-tolerant fir, and the potential for catastrophic wildfires. Although many of the SJNF landscapes may seem as though they are in a naturally appearing state, there is a potential for these landscapes to change from forested to non-forested conditions. Due to past fire suppression, aspen and ponderosa forests may see large-scale changes from wildfires because of reduced age-class diversity and the encroachment of shade-tolerant fir.

Existing Conditions Related to Oil and Gas Development

To better describe the existing condition as it relates to oil and gas development within the planning area, this section focuses on the four areas where oil and gas development may occur: Paradox Basin (BLM), Paradox Basin (USFS), the NSJB, and the San Juan Sag. These areas include landscapes that generally having positive, but ordinary or common, scenic qualities, as well as portions of the landscape with low scenic quality. The existing scenic condition includes existing oil and gas leases on which development of 1,100 more wells and associated facilities may occur.

Throughout these four areas, particularly the northwestern portion of NSJB and the northern Paradox Basin, the landscape has been modified by agricultural, residential, commercial, transportation, and oil and gas development.

A typical well site and access road affects 4 to 5 acres. The existing visual impact of oil and gas development includes many facilities and components such as tanks, pumpjacks, wellheads, fences, and signs. Wells and associated structures can impact views at all distance zones in the BLM Paradox Basin and the NSJB, but are often screened by vegetation and/or topography at middle ground and background zones. Most of these existing visual impacts occur in foreground views within 0.5 mile of viewers. There are no wellheads currently in the SJNF portion of the Paradox Basin or the San Juan Sag area. Oil and gas facilities are often readily visible from nearby residences, recreational areas, highways, and county roads.

- **Paradox Basin (BLM):** Currently the scenic condition in this area is primarily VRI Classes III and IV, meaning human modification is evident to most viewers throughout the area. The basin also has some small, interspersed areas of VRI Classes I and II that have much less evidence of human activity and modification. This area has low sensitivity due to few viewers and low screening potential due to the predominantly open landscape. The BLM portion of the Paradox Basin contains uranium leases and has approximately 150 operating wells that give an industrial character to portions of the landscape within those areas. Native vegetation has been cleared and access roads constructed to access the wells. A total of 235 wells may be developed in the BLM portion of the Paradox Basin over the next decade under existing leases. The Paradox Basin also contains the Spring Creek HMA, the Dolores Canyon WSA, and other unique features associated with the basin and the Dolores River. Therefore, although oil and gas development has potential to modify the visual appearance of the landscape, there are protections and terrain features that soften visual impacts across the geographic area of the basin.
- **Paradox Basin (USFS):** The current scenic condition for this area is moderate scenic integrity, which is a slightly altered landscape character. Due to the predominately open landscape, this area has low visibility with few viewers and low screening potential. It has a well-developed road network and substantial evidence of active vegetation management. However, it does not have the same level of oil and gas development as that of the BLM portion of the Paradox Basin.
- **NSJB:** The current scenic condition of this area is moderate to low scenic integrity, which is a slightly to moderately altered landscape character. Due to its mixed deciduous shrub and forest cover, this area has low to high visibility and medium screening potential. In the western portion of the area, approximately 300 wells have been developed on BLM, state, and private lands. An additional 750 wells may be developed on currently leased lands over the next decade. Also in the western BLM portion, five compressor stations are planned in an area where most of the current residential development also exists. There is currently substantial existing gas development visible from individual residences, county roads, and subdivisions, as well as from

within the WUI. There is visual impact from wells on NFS lands in the Saul's Creek area of the NSJB.

- **San Juan Sag Area:** The current scenic condition is moderate scenic integrity, which is a slightly altered landscape character with some locations of high and some locations of low scenic integrity. Due to varied terrain and forest cover, this area has moderate visibility and high screening potential. The San Juan Sag area has a well-developed road network; however, in other respects the area remains natural in appearance. There may be as many as 30 wells developed in the area at a rate of two wells per year.

In some areas, a legacy of oil and gas development has resulted in an accumulation of visual impacts. This limits the ability to conduct further future activities and still meet desired scenic objectives. Impacts attributable to oil and gas development include, but are not limited to, the following:

- Development of oil and gas has already resulted in visual impacts in the form of access roads, communication towers, well pad sites, pipeline corridors, compressor facilities.
- In some areas, recent exploratory activity for oil and gas has already resulted in impacts that may limit options for future activities in light of visual resource/scenery objectives for the areas.
- On BLM-administered lands, visual resources have to date been addressed on a site-specific basis, but the lack of a completed VRI for the BLM lands has pre-empted a landscape-scale approach to visual resources related to oil and gas development.
- Public concerns about maintaining scenic quality is increasing.
- Increasing WUI development is leading to increased demand for access roads, utility corridors, and cell phone relay towers. These facilities are changing the natural-appearing condition to a modified landscape where the where deviations strongly dominate the existing landscape character
- Large uninterrupted tracts of undeveloped lands are increasingly scarce and valued in the southwestern region, especially as residential development and populations grow.

Valued scenic and cultural landscapes associated with scenic byways remain in jeopardy of development and reduced scenic quality/integrity from a variety of sources, including oil and gas development. Larger numbers of visitors are anticipated to take up driving for pleasure as the overall population increases, and as the nation's population becomes older and less able to engage in more physically active forms of recreation away from primary road corridors.

3.15.3 Environmental Consequences

Direct and Indirect Impacts

Alternative A for BLM lands indicates that all BLM lands are "unclassified" because VRM classes have never before been assigned within the TRFO. Therefore, Alternative A reflects the continuation of no VRM area allocation decisions. The LRMP results in the first formal VRM allocations for BLM lands. For NFS lands, Alternative A reflects scenery objectives from the previous LRMP that would remain in effect if no action were taken to change scenery objectives in this LRMP/FEIS. Alternative A therefore represents a baseline for this visual/scenery management analysis of the other alternatives.

Alternative B has the highest proportion of land area allocated as VRM Class III for the BLM, allowing for a larger degree of modification of landscapes. This allows more management flexibility for the

agency, yet still requires that human modification does not dominate viewsheds or cause the casual viewer to perceive the landscape as primarily unnatural in appearance. This alternative also has less acreage in the least protective categories (VRM III and IV, SIO low and moderate) than Alternative D, but slightly more than Alternative A. This would allow for a greater degree of modification to those areas than that of Alternatives A and C.

Alternative C has the highest proportion of acreage in more protective management classes (VRM I and II, SIO high and very high). This would lead to a greater degree of protection for natural landscapes and less impact to the natural appearance of planning area landscapes.

Alternatives A and D in general have the highest proportion of acreage allocated to less restrictive scenery/visual resource objectives (VRM III and IV, SIO low and moderate). However, VRM Class II acreage is higher in Alternative D than that of Alternative B. This allocation would allow for greater overall changes to occur within the landscape under this alternative dependent on future development and project activity scenarios.

The above comparisons are summarized in general in Table 3.15.3, below, which characterizes the proportion of the planning area that would remain natural in appearance under the various alternatives.

See Volume III, Appendix V, Maps 40–43 for scenic integrity objectives and VRM classes by alternative.

Natural-appearing Landscape

The scenic integrity objectives very high, high, and moderate, and the VRM Classes I, II, and III would result in a relatively natural-appearing landscape. Alternative C would provide for more acres of natural-appearing landscape than would Alternatives A and D. This would be primarily due to the amount of oil and gas, timber harvesting, and fuels reduction activities expected under each alternative, as well as to the associated mitigation measures required for oil and gas development (stipulations).

Impacts Related to Fire and Fuels Management

All of the alternatives would include treatment for fuels reduction (including mechanical and prescribed burns). Fuels reduction efforts may result in short-term negative scenic impacts, as well as a lowered scenic integrity due to cut vegetation, slash, and disturbed soils. Planning for scenic elements and adherence to standards and guidelines would minimize short-term impacts and reap long-term scenic benefits, meeting scenic integrity objectives.

Fuels reduction activities may result in a more stable forest condition, which may then better resist catastrophic wildfires. Without fuels reduction treatments, catastrophic wildfires may be more likely, and indirect negative impacts may be more likely to result from the use of bulldozers in fire suppression or development of roads for post-fire timber salvage. Natural disturbance factors, such as low-intensity wildfire, have the potential to alter the appearance of the planning area. Periodic low-intensity wildfire is a natural disturbance factor that may change scenic conditions; however, it may have no direct impact on scenic integrity. Generally, low-intensity fire (wild or prescribed) may result in long-term beneficial impacts to scenery.

Alternative D would propose to treat slightly more acres than would the other alternatives; therefore, it would result in the greatest impacts to scenery, in terms of short-term degradation and long-term benefits.

Impacts Related to Vegetation Management

Timber management activities typically reduce scenic quality in the short term due to the associated visible slash, stumps, landings, and roads. In the long-term, harvesting activities may maintain or enhance scenic qualities and scenic stability, and the ability to resist insects, disease, and catastrophic wildfire. However, with proper planning prior to timber management activities taking place, treated areas should meet the adopted SIO within 2 to 5 years after harvest.

Historic treatments within the planning area have mostly included selective harvesting of ponderosa pine and mixed conifer, clear-cutting of aspen, and thinning of pinyon and juniper trees. Future treatments would use the same prescriptions. Selective tree cutting and partial cutting may enhance forest scenery in the long term. This is because this activity may result in more open park-like groves of trees, enhance structural and species diversity, create vistas, and reduce susceptibility to wildfire. Aspen clear-cutting may result in large-scale openings that have short-term negative elements (including stumps, slash, crushed trees, landings, disturbed soil and ground vegetation, and roads). In the long term, these openings may regenerate with highly valued groves of scenic aspen.

Under all of the alternatives, the short-term impacts related to timber management activities may be adverse. Long-term impacts may be positive to scenic values. Long- and short-term impacts to scenery would be the greatest under Alternative D, which would treat more acres and reconstruct more road miles than would Alternatives A, B, or C.

Impacts Related to Facilities

The main variables that influence the number of new facilities, as well as the maintenance and restoration of old facilities, are budget, adherence to design guidelines, and partnerships. Since these variables are expected to be the same under all of the alternatives, the related impact to scenic integrity of managing existing facilities and developing new facilities is expected to be site-specific and similar under all of the alternatives.

Impacts Related to Utility Corridors

The potential impacts of utility corridors on scenery may be the same under all of the alternatives. Site-specific analysis would be undertaken for projects involving new or existing utilities. When this occurs, scenic issues would be identified and addressed.

Impacts Related to Roads and Trails

Impacts related to roads and trails may include higher road and trail densities within areas suitable for motorized recreation; increased soil and ground-cover disturbance associated with parking, dispersed camping, trail use, and motor vehicle travel; and increased number of signs and gates in the landscape. Alternative C would have fewer impacts related to roads and trails than would the other alternatives. This is due to the reduced area considered suitable for motorized recreation use under Alternative C, as well as the reduced road use for active management.

Travel routes may have a positive social benefit, in that they provide places for people to access and view scenery. From that standpoint, Alternative C would provide the least benefit.

Alternatives D, A, B, and C, respectively, would have the greatest to least adverse impacts to visual resources, even though the travel routes may have a beneficial impact by providing access for people to view scenery.

Impacts Related to Air, Fish, Wildlife, Water, Invasive Plants, and Livestock Management

Potential impacts may be the same under all of the alternatives. Direct impacts may include site-specific construction of structures (including fencing, stock tank installation, water pipelines, and watershed protection structures). The impacts related to these elements would be local. Site-specific planning and design would be undertaken in order to limit adverse impacts to scenery while, at the same time, taking every opportunity to enhance scenery. As a result, these features may be installed so that they are noticeable to the casual observer, but do not dominate the view.

Impacts Related to Fluid Minerals Management

The analysis of direct and indirect impacts involves approximately 435,000 federal acres on which as many as 170 new wells could be constructed (if the RFD scenario were completely realized). These wells and associated ancillary facilities may directly impact approximately 650 acres. Impacts from, and differences between, alternatives are herein described for the four areas where oil and gas development may occur: Paradox Basin (BLM), Paradox Basin (USFS), the NSJB, and the San Juan Sag.

The potential visual impact of oil and gas development may include components such as tanks, pumps, pits, compressors, pipelines, fences, and signs. Standard leasing stipulations, shown in Table 3.15.2, are incorporated in this LRMP to reduce, but not eliminate, visual impacts due to oil and gas developments.

Table 3.15.2: Lease Stipulations Related to Recreation and Scenery

Recreation and Scenery	Alternative A	Alternative B	Alternative C	Alternative D
Developed administrative and recreation sites: Within 0.25 mile around developed administrative and/or recreation sites.	NSO	NSO	NSO	NSO
Developed administrative and recreation sites: Surface use or occupancy would be prohibited unless or until the operator demonstrates that operations can be acceptably conducted within 1 mile of developed administrative and recreation sites.	CSU	CSU	NSO	SLT
SRMAs: Durango, Dolores River Canyon, Silverton, Cortez.	SLT	CSU	CSU	SLT
National scenic byways, All-American Roads, and backcountry byways; designated scenic, recreation, and historic trails; and recreation-emphasis corridors: Within the identified foreground viewshed, up to 0.5 mile on either side of the following: San Juan Skyway, Trail of the Ancients, the Alpine Loop Back Country Byway, Old Spanish Trail, Continental Divide Trail, Colorado Trail, Calico Trail, Highline Loop Trail, East Fork Road, West Fork Road, First Notch Road, Piedra Road, Poison Park Road, Lime Creek Road, South Mineral Road, La Plata Canyon Road, West Dolores Road, and Durango-Silverton Narrow Gauge Railroad.	CSU/NSO	NSO	NSO	CSU
Old Spanish Trail: No surface-disturbing activities up to 0.5 mile of either side of the centerline of the congressionally designated trail in high potential	SLT	NSO 0.5 mile	NSO 5 miles	NSO 0.5 mile

Recreation and Scenery	Alternative A	Alternative B	Alternative C	Alternative D
segments.				
Old Spanish Trail-visual: CSU for the horizon on either side of the centerline of the congressionally designated trail in high potential segments.	SLT	CSU	CSU	SLT
High SIO and VRM Class II Areas	CSU	NSO	NSO	SLT
Area-specific				
Dolores River Canyon	NSO	NSO	NAL	NSO
IRAs	NSO	NSO	NAL	NSO
State wildlife areas: Bodo, Dan Noble, Dry Creek, Lone Cone, Lone Dome, Perins, Puett Reservoir, Williams Reservoir, Coalbed Canyon, Devil Creek, Fish Cr., Haviland, and Joe Moore.	SLT	NSO	NAL	CSU
WSRs	NSO	NSO	NSO	NSO
MA 8 - highly developed areas and ski areas (NSO)	NSO	NSO	NSO	NSO
Existing and proposed RNAs (NSO)	NSO	NSO	NAL	NSO
ACECs: Mud Springs (cultural), San Miguel Basin and Dove Cr. (Gunnison sage-grouse, plants), Gypsum Valley (soils and plants)	NSO- Mud Springs	SLT	NAL	SLT
Lands managed for wilderness charateristics	SLT	NSO	NAL	CSU
WSAs	NAL	NAL	NAL	NAL
NAL = Not available for lease.				

Under standard lease terms there is a higher degree of risk than with stipulations specific to visual mitigation that visual quality objectives would not meet visual management guidelines. For example, the inability to move a proposed operation more than 200 meters would make it unlikely that the operation would meet visual quality objectives in SIO very high or high (VRM II) areas.

The visual impacts of oil and gas development may change depending on the actual site-specific project location for each well and structure, as well as the leasing stipulations described under each alternative (see Table 3.15.4). Alternatives B, C, and D have potential for more well development and, consequently, more impacts. However, the action alternatives do have more restrictive stipulations aimed at the protection of scenic values than does Alternative A.

Alternative Comparison – Oil and Gas Leasing: Each alternative has different objectives for VRM and scenic integrity, which are coupled with and different stipulations. Alternatives B, C, and D prescribe CSU to selected viewsheds and areas with moderate SIOs and NSO stipulations to buffer scenic byways, national scenic trails, recreation emphasis corridors, and historic trails and protect scenic quality. The CSU and NSO stipulations of Alternatives B, C, and D would result in lower visual impact than leasing Alternative A, which prescribes less restrictive stipulations. Based on the projected number of wells developed under the leasing alternatives and the lease stipulations applied, leasing Alternatives A and D would have the greatest potential to impact visual quality followed by leasing Alternatives B and C. In all leasing alternatives, lease stipulations, standards, guidelines, and referenced management direction specified in Volume II, LRMP would be applied to mitigate the visual impacts of oil and gas development.

In Alternatives B, C, and D, NSO would be applied to foreground areas with a high SIO or VRM Class II for the purpose of protecting the scenic values of such areas. These two classifications are the areas where viewers would expect high scenic integrity within the foreground viewshed, and where

the landscape is to be managed for an overall high SIO. Oil and gas exploration and production is typically not compatible with the maintenance of a high scenic integrity (VRM Class II) in the foreground and middle ground distance zones. In Alternative A, standard lease terms would be applied to similar settings. Depending on the terrain and the proposal, standard lease terms would provide the highest risk of not protecting visual quality where there are high SIOs. A CSU stipulation would give the land managers more latitude to relocate proposed activities and minimize adverse impacts but the NSO more effectively mitigates potential impacts to visual quality by prohibiting surface occupancy.

A CSU stipulation would apply to mapped foreground areas with VRM Class III or moderate SIO in Alternatives B, C, and D. This stipulation would be used to assure that site selection and planning, design, and mitigation are applied within landscapes that have these scenery objectives and should satisfy concerns regarding visual impacts of oil and gas development in VRM Class III areas. These areas are places where people have a high or moderate concern for scenic quality and where, generally, active resource management is allowed and may affect the scenic and recreation setting. Alternative A would require the management constraints of standard lease terms only. Depending on the terrain and the proposal, standard lease terms under Alterative A have the highest risk of not protecting visual quality where some modification is allowed (e.g., high or moderate SIO or VRM Classes II and III).

NSO would apply to historic trails and recreation emphasis corridors within the identified foreground, up to 0.5 mile on either side of the following in the PLAA: San Juan Skyway, Trail of the Ancients, Old Spanish Trail, CDNST, Calico Trail, Highline Loop Trail, and West Dolores Road. The NSO stipulation would protect the integrity of viewsheds in scenic and cultural landscapes along significant touring routes and scenic drives. Typically these foreground viewsheds are the most sensitive in terms of visitor expectations for high quality scenery that is compatible with the special route designation. The visible evidence of oil and gas development would be considered inconsistent with the maintenance of high scenic integrity in the foreground of these routes in Alternatives B, C, and D, but not in A where standard stipulations apply.

The No Leasing Alternative would not make any additional BLM or NFS lands available for lease, so consequently lease stipulations do not apply under this alternative. Under the No Lease Alternative, oil and gas development would still proceed on existing leases. The potential visual impacts would be approximately one-half of that projected in Alternatives A through D and would be concentrated in the northwest portion of the PLAA.

The high oil and gas potential areas of the SJNF and TRFO are within a landscape that generally has positive, but ordinary or common, scenic qualities. The northwest portion of the planning area has been modified by agricultural, residential, commercial, transportation, and oil and gas development. Well structures currently impact views at all distance zones in the BLM portion of the Paradox Basin. There are no wellheads currently in the SJNF portion of the Paradox Basin. Most of these existing visual impacts occur in foreground views within 0.5 mile of viewers. Oil and gas facilities are readily visible from nearby residences, recreational areas, highways, and county roads.

Generally, the impacts to scenic resources would be the greatest in the sparsely vegetated, lower-elevation areas of the Paradox Basin and the NSJB. The visual impact of oil and gas development would depend substantially on terrain and vegetative cover (screening capacity). Furthermore, where varied terrain screens a development, the varied topography may result in extensive grading that could detract from scenic quality. To avoid this grading, oil and gas developments may be located on valley bottoms, which are places that may directly impact the views of traveling recreationists.

The current scenic condition for the SJNF portion of the Paradox Basin is moderate scenic integrity, which is a slightly altered landscape character. Due to the predominately open landscape, this area has low screening potential. It has a well-developed road network and substantial evidence of active vegetation management; however, it does not have the same level of oil and gas development as that of the BLM portion of the Paradox Basin. The BLM portion of the Paradox Basin has approximately 90 operating wells that, in patchy areas, result in an industrial landscape character. Approximately 550 wells may be developed on future leases on the BLM and NFS lands in the Paradox Basin over the next 15 years. Full development of existing leases would add proportionally to the visual impacts over the life of the LRMP, although leasing stipulations and BMPs would be applied to all new wells and developments to mitigate these impacts.

The effects of oil and gas development depend substantially on successful application of BMPs. The scenic effects disclosed within this FEIS assume that appropriate BMPs are applied extensively to all oil and gas development, whether under existing leases or future leases, and address both site-specific and cumulative impacts.

In addition to the lease stipulations, management standards, guidelines, BMPs, and other referenced direction would be used to protect scenic resources. These requirements and the BMPs below, if not already expressed as a lease stipulation, would be made part of surface use plans of operation attached to APDs as COAs:

- USDA Handbook 701, Landscape Aesthetics
- USFS Publication FS-710, The Built Environment Image Guide (USFS 2001)
- BLM Handbook 8410-1, Visual Resource Inventory
- BLM Handbook 8431-1, Visual Resource Contrast Rating
- USDOI Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – The Gold Book. 4th ed. 2006 BLM/WO/ST-06/021+3071 (BLM and USFS 2007)
- USFS 2007 Final Decision for SJCBM Scenic Mitigations Conditions of Approval (USFS 2007a)
- Visual Resource Management for Fluid Minerals Best Management Practices (USFS 2007a)
- Visual Resource Management BMPs for Fluid Minerals (USFS 2007a)

Visual Impacts of Linear Features, Well Pads, and Associated Facilities: In the middle ground and foreground distance zones, well pads and access roads would be the most obvious feature of oil and gas development. Development of linear facilities (including oil and gas pipelines and roads) may involve clearing dense vegetation and construction on steep slopes. Pipeline, road, and well pad construction may present an obvious contrast in color with the surrounding vegetation. These cleared areas may be visually prominent at foreground and middle ground distance zones for more than a decade.

Disturbed areas associated with well pads, roads, and pipelines would be the most obvious immediately after construction. Impacts would decrease as the disturbed surface began to blend in color, form, and texture when interim reclamation occurs.

Visual impacts of well pads, roads, and pipelines would be the most obvious immediately after construction. Impacts would decrease when interim reclamation occurs and the disturbed surface began to blend in color, form, and texture. In the harsh conditions of portions of the PLAA, it may take 10 years or more to establish a cover of grasses and shrubs. If a well is non-productive, site reclamation would occur immediately. Approximately 10% of wells in the PLAA would be non-productive. When wells are abandoned, the facilities would be removed and the entire pad would be contoured and planted in order to blend with the existing topography and vegetation.

Short-term impacts may occur where construction-related equipment, activities, and dust would be visible to observers. During the 10- to 12-day construction period, the presence of heavy equipment and dust generated by construction and traffic may detract from the visual quality of the landscape at each well location. These actions may be visually intrusive to visitors and residents but are generally short term in nature. Visual impacts may be greater for well locations near residential areas, along roads, and in open areas that are not screened by topography or vegetation.

Modified landscapes would have long-term visual impacts at well sites, which may persist for as long as 50 years, depending on production period and reclamation. Long-term impacts may include vegetation removal, alteration of the landscape, and installation of equipment and facilities. These impacts may cluster in some highly productive locations, which may ultimately result in an industrial landscape character.

The most visible component of the proposed facilities would be the pumping units at each well site, as well as the clear-cuts associated with roads, pads, and flowlines. Gas-gathering and water pipelines would be buried adjacent to, or within, ROWs for existing and new roads. These impacts typically change the road character from narrow and rugged to wider lanes and clearance widths. This may have the effect of substantially changing the recreation setting, as well as degrading the natural appearance of the foreground. However, when compared to siting pipelines and utilities along separate cleared corridors, the overall visual impact to the landscape is often reduced.

When abandoned, the facilities would be removed and the wells plugged. The entire pad would be contoured and planted in order to blend with the existing topography and vegetation. Reclamation of the long-term visual disturbance from construction of well pads, roads, facilities, and pipelines would be a decades-long process, with a typically slow rate of vegetative recovery due to the arid conditions in the Southwest.

Flaring and Compressor Lighting: Other elements that may degrade scenic quality include activities or components of the facility that result in lighting contrasts (including flaring and lighting from compressor stations). Flaring is a common practice that occurs only when the well is being developed. It is estimated that only one to three wells would be flaring at any one time in the RFD area. Flaring would result in a short-term impact that may last from 3 to 5 days.

Nighttime lighting of compressor stations may be a long-term impact that could substantially degrade scenic quality. However, the use of motion-activated lights in combination with shielded and focused fixtures may greatly reduce or eliminate this impact.

Table 3.15.3: Direct Impacts Related to Well Development

Well Facility (CBM and conventional)	Frequency of Occurrence[1]	Foreground (0–0.50 miles)[2]	Middle Ground (0.50–3 to 5 miles)[2]	Background (middle ground to infinity)[2]
Well head	Common	P	U	U

Well Facility (CBM and conventional)	Frequency of Occurrence[1]	Foreground (0–0.50 miles)[2]	Middle Ground (0.50–3 to 5 miles)[2]	Background (middle ground to infinity)[2]
Separator	Common	P	U	U
Meter house	Common	P	U	U
Pump jack (CBM)	Moderate	P	U	U
Dehydrator	Sporadic	P	U	U
Condensate tank	Sporadic	P	S	U
On-site water storage tanks	Moderate	P	S	U
Uncovered pit for produced water	Sporadic	S	U	U
Covered pit for produced water	Sporadic	S	S	U
Cathodic protection well	Sporadic	S	U	U
Support Facilities				
Water injection well facilities	Sporadic	P	P	S
Compressor station/gas plant	Sporadic	P	P	S
Linear Elements				
Access roads	Common	P	P	S
Gathering pipeline	Common	P	P	S
Transmission pipeline	Common	P	P	S
Well pad	Common	P	S/P[3]	U/S[4]

[1]Sporadic occurance = very few structures; Moderate occurrence = found with only one type of well, optional components of well; Common occurrence = widespread, common distribution of wells

[2]P = prominent, dominates surrounding setting; S = subordinate, begins to attract attention; U = unnoticed, does not attract attention

[3]S if partially reclaimed, P if not partially reclaimed

[4]U if partially reclaimed, S if not partially reclaimed

Effects of No Leasing Alternative

The effects to scenery of no new leasing would be much the same as what is described under the action alternatives as all valid existing leases would continue to be developed using BMPs regardless of this LRMP decision. If new leases were issued and fully developed under the life of the LRMP, there would be some additional impacts to visual and scenic resources due to the expanded scope of oil and gas development proportional to the newly leased land area leased. Under all oil and gas development scenarios, all future development would be consistent with BMPs and would be required to meet scenery and visual standards for protection of those resources throughout the SJNF and TRFO.

Cumulative Impacts

Fuels reduction, timber sales, and oil and gas development activities combine to result in cumulative impacts to scenery within portions of the planning area, reducing the overall scenic integrity of the landscape. However, the limited geographic scope of oil and gas leasing, permit stipulations, and visual resource mitigation measures under BMPs would be employed to reduce these impacts to

acceptable levels within the various SIO/VRM zones. Table 3.15.6 shows a comparison of visual integrity per each alternative, which can be used to determine the relative magnitude of potential cumulative impacts for the alternatives.

The cumulative impacts related to oil and gas activity associated with new leases, combined with existing leases, may be major and extensive on portions of the planning area and be visually obvious to the casual observer. Approximately 170 new wells may be constructed on new leases under Alternatives B, C, and D. An estimated 1,000 wells may be permitted on existing leases over the next 15 years under all of the alternatives. The narrative below (and Table 3.15.6) summarizes the extent and magnitude of visual/scenic resource impacts in light of the variable development scenarios presented in the alternatives. When both existing and potential future oil and gas leases are considered together, these activities would increase impacts to visual and scenic resources. For example, if all existing and potential future leases were to be fully developed, the impacted area would essentially double across the landscape.

Cumulative visual impacts would also result from development of federal lands concurrent with development of private leases within or adjacent to the areas of projected development. Within the Paradox Basin, new oil and gas development totaling 700 wells is projected on private lands immediately adjacent to and to the west of the PLAA. This development could occur near and be visible from county roads that serve as a gateway to public lands. The private land development would increase the magnitude and extent of an industrial appearing landscape encountered by residents and visitors.

Table 3.15.4: Cumulative Impacts Related to Oil and Gas Development

Alternative	Existing Condition	Alternative A	Alternative B	Alternative C	Alternative D
Paradox Basin (BLM)	Change attracts attention but does not dominate views. Natural landscape character predominates.	Major modification of the natural landscape character. Management activities may dominate the view and are major focus.	Change attracts attention but does not dominate views. Natural landscape character predominates.	Change attracts attention but does not dominate views. Natural landscape character predominates.	Change attracts attention but does not dominate views. Natural landscape character predominates
Paradox Basin (USFS)	Natural landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Natural landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Natural landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Natural landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Natural landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.

Alternative	Existing Condition	Alternative A	Alternative B	Alternative C	Alternative D
NSJB	Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.
San Juan Sag	Landscape character appears intact. Management activities are not visually evident.	Landscape character appears slightly altered. Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Landscape character appears slightly altered. Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Landscape character appears slightly altered. Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.	Landscape character appears slightly altered. Landscape character appears slightly altered. Management activities remain visually subordinate to the landscape being viewed.

Cumulatively, oil and gas development in the RFD area may impact approximately 3,000 acres, or 1% of the RFD area in addition to the 2,100 acres of current impact. As many as 1,200 wells, as well as an unknown number of compressors, could be developed in the RFD area. Approximately 60% of these facilities would be on federal land.

The cumulative effects analysis includes existing oil and gas leases within the four areas on which development of 1,100 more wells and associated facilities may occur.

- **Paradox Basin (BLM):** Under all alternatives, there could be an additional development of 235 wells on already leased land. This may result in a VRM Class III if effective BMPs are applied. The industrial features of the oil and gas development would be visually evident in the landscape of the Paradox Basin. However, the cumulative effect on the landscape is expected to be partial retention of natural character.
- **Paradox Basin (USFS):** Under all alternatives, this area would achieve a moderate scenic integrity (slightly altered).
- **NSJB:** Under all alternatives, this area would achieve a moderate scenic integrity (slightly altered).
- **San Juan Sag Area:** Visual impacts of oil and gas development in the San Juan Sag area would be minor. The area where development may take place has terrain and vegetation to screen most development. Exceptions may occur where companies propose exploratory wells within a specific location in order to test a potential oil or gas trap. In such cases, there may be less flexibility to site facilities away from road corridors or to fully utilize screening techniques. Most well development in the San Juan Sag area would be exploratory in nature, and facilities may be temporary. These disturbed locations would present a visible contrast to the observer for a period of several years. The duration of this impact would depend on the application of BMPs and the success of reclamation.

Other Contributing Factors

Residential and commercial growth would continue along U.S. Highway 160, as well as near many of the county roads north of U.S. Highway 160. Tourism travel would expose more visitors to areas of the Paradox Basin. Oil and gas well operations and facilities would gain greater visibility. Even with the best mitigation and development techniques, site planning, and facility design in the NSJB and the Paradox Basin (BLM), the extensive amount of development would result in viewers (primarily residents on private land and visitors traveling through) experiencing a landscape that is moderately altered by industrial features.

3.16 Heritage and Cultural Resources

3.16.1 Introduction

The planning area is situated in the heart of an area with a long and rich prehistoric and historic record. Native American occupation of the area dates back approximately 10,000 years. The archaeological record contains some of the earliest agricultural societies in the region. The historic period brought Spanish and Euro-American explorers, trappers, miners, and settlers into the region. This long record of human occupation has left one of the highest densities of prehistoric and historic heritage and cultural resources to be found in the United States. These sites have national, international, and Native American tribal significance.

Heritage and cultural resources are non-renewable resources that include historic and prehistoric artifacts, structures, sites, districts, and archival materials important for their scientific, educational, economic, and social values. Throughout the region advanced archaeological and historical research is an ongoing endeavor. There is a great public interest in visitation to heritage and cultural resources. This visitation is an integral part of the region’s economy. Twenty-six Native American tribes and pueblos claim cultural affiliation with heritage and cultural resources located within the planning area.

The SJNF and TRFO are responsible for identifying, evaluating, and protecting heritage and cultural resources on the public lands they manage. The SJNF and TRFO have established an active heritage and cultural resource program that has focused on identifying, preserving, and interpreting heritage and cultural resources, as well as providing research opportunities for the most significant resources.

Legal and Administrative Framework

Laws

The laws, regulations, and policies below, in addition to the direction detailed in the LRMP, provide for the basis for USFS and BLM management of cultural and heritage resources within the planning area.

- **The Antiquities Act of 1906:** This act authorizes the President to declare federal lands as national monuments for the purpose of protecting sites and objects of antiquity.
- **The Historic Sites Act of 1935:** This act provided the earliest, and most basic, legislation for protecting cultural resources on federal lands. It provides misdemeanor-level criminal penalties to control unauthorized uses. Appropriate scientific uses may be authorized through permits, and materials removed under a permit must be permanently preserved in a public museum. The 1906

act is broader in scope than the 1979 Archaeological Resources Protection Act, which partially supersedes it.

- **The National Historic Preservation Act of 1966, as amended:** This act created the NRHP, the list of National Historic Landmarks, and the posts of State Historic Preservation Offices, with the intent of preserving historical and archaeological sites. The act requires federal agencies to evaluate the impacts of all government-funded construction projects through a process known as "Section 106 Review." Under the act, agencies maintain their own preservation program enjoined by advisory councils on historic preservation.
- **The National Environmental Policy Act of 1969:** NEPA promotes efforts that would prevent or eliminate damage to the environment and biosphere, and enrich the understanding of the ecological systems and natural resources important to the nation.
- **The Federal Land Policy and Management Act of 1976:** FLPMA declares that "…the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values." It also states, "Terms and conditions must minimize damage to scenic and aesthetic values and fish and wildlife habitat and otherwise protect the environment."
- **The American Indian Religious Freedom Act of 1978:** This act established national policy designed to protect and preserve, for Native Americans, their inherent right of freedom to believe, express, and exercise their traditional religions (including the rights of access to religious sites, use and possession of sacred objects) and freedom to worship through traditional ceremonies and rites.
- **The Archaeological Resources Protection Act of 1979:** This act provides for the protection of archaeological resources and sites that are on public lands, and Native American tribal lands, in order to foster increased cooperation and the exchange of information between governmental authorities, the professional archaeological community, and private individuals.
- **The Native American Graves Protection and Repatriation Act of 1990:** This act provides a process for museums and federal agencies to return certain Native American cultural items (including human remains, funerary objects, sacred objects, and objects of cultural patrimony) to lineal descendants, culturally affiliated Indian tribes, and Native Hawaiian organizations.
- **National Trails System Act of 1968 (PL 90-543), as amended (2002):** This amendment to the National Trails System Act created the Old Spanish National Historic Trail.

Executive Orders

- **EO 11593:** This EO provides for the protection and enhancement of the cultural environment.
- **EO 13007:** This EO provides policy with regard to Indian sacred sites.
- **EO 13084:** This EO provides policy with regard to consultation and coordination with Native American tribal governments.
- **EO 13195:** This EO provides policy with regard to "Trails for America in the 21st Century."
- **EO 13287:** This EO establishes federal policy designed to provide leadership in preserving America's heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the federal government.

Regulations and Policies

- **43 CFR 3**: This provides policy with regard to the preservation of American antiquities and implementing regulations for the Antiquities Act.
- **36 CFR 7**: This provides policy for the protection of archaeological resources.
- **43 CFR 10**: This provides policy in line with the Native American Graves Protection and Repatriation Act Regulations; Final Rule.
- **36 CFR 79**: This provides for the curation of federally owned and administered archaeological collections.
- **36 CFR 60**: This provides policy in line with the NRHP.
- **36 CFR 800**: This provides for the protection of historic properties.
- **BLM Manuals 8100, 8110, 8120, H-8120-1, 8131, 8140, 8150, and 8170**: These provide policy and program guidance for the management of cultural resources
- **FSM 2360, Revised 2008**: USFS Heritage Program Management
- **BLM Departmental Manual Part 411 Museum Property Management (1997)**
- **San Juan Public Lands Fire Management Plan and Appendix B—Polygons (2004) (USFS 2004d)**
- **BLM Emergency Fire Rehabilitation Handbook, H-1742**
- **BLM IM No. CO-90-072 (BLM 1990a)**: This provides policy regarding “Colorado Burial Discovery Procedures.”
- **BLM IM No. CO-98-052 (BLM 1998)**: This provides policy regarding “Clarification of Cultural Resource Clearance Responsibilities and Maintenance on Ongoing Projects.”
- **BLM IM No. CO-2000-016 (BLM 2000)**: This provides policy regarding “Disposition Policy on Native American Graves Protection and Repatriation Act (NAGPRA) Repatriated Museum Collections.”
- **BLM IM IB No. WO-2002-002 (BLM 2002b)**: This provides policy regarding the “New Heritage Education Plan.”
- **BLM IM No. CO-2002-029 (BLM 2002c)**: This provides policy regarding “Interim Historic Preservation Guidelines and Procedures for Evaluating the Effect of Rangeland Management Activities on Historic Properties.”
- **BLM IB No. WO-2002-101 (BLM 2002d)**: This provides policy regarding “Cultural Resource Considerations in Resource Management Plans.”
- **BLM IB No. WO-2003-093 (BLM 2003c)**: This provides policy regarding “Implementation of Executive Order (EO) 13287 and Preserve America Initiative.”
- **BLM IM No. WO-2003-147 (BLM 2003d)**: This provides policy regarding “Application for Permit to Drill (APD) – Process Improvement #3 – Cultural Resources.”
- **BLM IM No. WO 2004-020 (BLM 2004a)**: This provides policy regarding “Guidance for Recording Cultural and Paleontological Resource Locations for the Bureau of Land Management using Global Positioning System Technology.”

- **BLM IM No. WO-2004-052 (BLM 2004b)**: This provides policy regarding “Assessing Tribal and Cultural Considerations as Required in IM-2003-233, Integration of the Energy Policy and Conservation Act (EPCA) Inventory Results into the Land Use Planning Process.”
- **BLM IB No. WO-2004-154 (BLM 2004c)**: This provides policy regarding “Amendments to 36 CFR Part 800, Protection of Historic Properties.”
- **BLM IM No. WO-2005-003 (BLM 2005c)**: This provides policy regarding “Cultural Resources and Tribal Consultation and Fluid Minerals Leasing.”
- **BLM IM No. WO-2005-027 (BLM 2005b)**: This provides policy regarding “National Historic Preservation Act (NHPA) Section 106 and Oil and Gas Permitting.”
- **BLM IM No. CO-2006-026 (BLM 2006c)**: This provides policy regarding “Cultural Resource Standards and Guidelines for Renewal of Right-of-Way grants and Temporary Use Permits under Section 106 of the National Historic Preservation Act.”
- **BLM IM No. WO-2007-002 (BLM 2007d)**: This provides policy regarding “Disposition Policy on Native American Graves Protection and Repatriation Act Repatriated Museum Collections.”

Other Agreements

- Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers regarding the manner in which the BLM would meet its responsibilities under the NHPA (BLM and the Advisory Council 1997).
- State Protocol Agreement between the Colorado State Director of the BLM and the Colorado State Historic Preservation Officer regarding the manner in which the BLM would meet its responsibilities under the NHPA and the National Programmatic Agreement among BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (1998).
- Programmatic Agreement among the BLM, the State of Colorado, the USFS, the State Historic Preservation Office of Colorado, and the Advisory Council on Historic Preservation regarding the Management of Wildland Fire for Resource Benefits (Agreement No. 1102-002-98-038).
- Addendum 1 to the BLM Colorado Protocol: Section 106 Requirements for Comprehensive Travel and Transportation Management Planning (BLM 2007e).
- Standard Range Recission Strategy for Cultural Resources, San Juan National Forest (USFS 2008d).
- Programmatic Agreement between the USFS and the Advisory Council on Historic Preservation, Regarding Rangeland Management Activities on NFS lands (USFS 2007c).
- Programmatic Agreement among the Advisory Council on Historic Preservation, the Colorado State Historic Preservation Officer, and the USFS Rocky Mountain Region, Arapaho and Roosevelt National Forests, Cimarron-Comanche National Grasslands, Grand Mesa, Uncompahgre and Gunnison National Forests, Medicine Bow-Routt National Forests, Pawnee National Grassland, Pike and San Isabel National Forests, Rio Grande National Forest, and San Juan National Forest Regarding the Reporting of Negative Results Cultural Resource Inventories (Advisory Council et al. 2010).

3.16.2 Affected Environment

Existing Conditions and Trends

As of February 2012, BLM-administered lands within the planning area contained approximately 5,434 previously recorded heritage/cultural resources. As of February 2012, NFS lands within the planning area contained approximately 5,919 previously recorded heritage/cultural resources. These heritage/cultural resources represent a variety of site types and chronological periods. The estimated density of sites on BLM lands is approximately 16 sites per square mile. The estimated density of sites on NFS lands is estimated to be approximately 2.8 sites per square mile. Together, these resources document an almost continuous record of human occupation in the planning area for more than 10,000 years.

In general, cultural resources are identified through field inventories conducted by qualified professionals in order to comply with Section 106 of the NHPA of 1966. Informant information and historical records are also used to identify archaeological, historical, and traditional values. Three types of inventories are conducted in order to identify and assess these values on public lands: Class I, Class II, and Class III. An estimated 14% of the BLM lands and 9% of the NFS lands have been inventoried for heritage/cultural resources at the Class III level within the planning area. A majority of the Class III inventories were associated with federal undertakings where cultural properties needed to be identified and evaluated in order to protect significant values and to minimize impacts on these values.

Four Class I level overviews of prehistoric and historic resources in southwest Colorado encompass the planning area and provide a synthesis of available information (Collins et al. 2006; Duke1998; Lipe et al. 1999; Reed and Metcalf 1999). The *Class I of Cultural Resources Overview of Bureau of Land Management* by Collins et al. (2006) divides the BLM lands into 23 geographic units. A predictive model for each of these geographic units was developed that identifies areas with high, medium, and low site potential. This Class I overview also developed management recommendations for each geographic unit (including recommendations for archaeological inventory, monitoring, evaluating sites, and development of cultural RMPs).

Of the 5,274 known sites on the BLM lands within the planning area, 737 have been determined to be eligible for the NRHP, 3,959 have been determined to be not eligible for the NRHP, and 578 need more data before a determination of eligibility for the NRHP can be made. Of these eligible sites, three Historic Districts—Animas Forks Townsite, Gold Prince Mine, Mill and Tram, and the Tobasco Mine, Mill and Tram—and three sites, the Minnie Gulch Cabin, Placer Gulch Boarding House, and Prospect Gulch Cabin, have been listed on the NRHP. Of the 5,919 known sites on the NFS lands within the planning area, 1,132 sites have been determined to be eligible for the NRHP. Of these 1,132 eligible sites, 999 have been formally listed on the NRHP. This includes contributing sites within the Anasazi Archaeological District, Lost Canyon Archaeological District, Spring Creek Archaeological District, Falls Creek Archaeological Area, and Chimney Rock Archaeological District. There are three designated National Historic Landmarks that incorporate, or are adjacent to, public lands: Silverton National Historic Landmark, Durango-Silverton Narrow Gauge Railroad National Historic Landmark, and Shenandoah-Dives Mill National Historic Landmark. National historic trails traversing the planning area include the Dominguez-Escalante National Historic Trail and the Old Spanish National Historic Trail. Authorized by Congress in December 2002, the Old Spanish National Historic Trail commemorates the Santa Fe to Los Angeles route that forged the first overland link from Santa Fe to California. The BLM and NPS are currently writing a Comprehensive Management Plan and Draft EIS to guide the trail's development. While the Old Spanish National Historic Trail is currently mapped as

crossing the planning area, very few localities associated with the trail have actually been identified and ground-truthed.

The planning area currently has two special management areas on NFS lands designated for the protection and management of heritage/cultural resources, the Falls Creek Archaeological Area and the Chimney Rock Archaeological Area, and one on BLM lands—the Anasazi Culture Area ACEC. The Anasazi Culture Area ACEC was originally established in 1985. The majority of lands within the ACEC were designated as the Canyons of the Ancients National Monument in 2000. The lands remaining within the Anasazi Cultural Area ACEC are those lands referred to by the BLM Class I overview (2006) as the Mud Springs Geographic Unit (which still contains a high density of significant prehistoric sites). When Canyons of the Ancients National Monument was created the Mud Springs area was originally slated for inclusion, but for various reasons, was omitted from the monument designation.

The LRMP would add one additional special management area on NFS lands, the McPhee Special Management Area, and one special management area on BLM lands, the Mesa Verde Escarpment. Both of these special management areas would emphasize the protection and management of heritage and cultural resources. The LRMP would also expand the boundaries of the Chimney Rock Archaeological Area. Since 2009 there has been tremendous support from local, state, and federal public officials, organizations, and the public to designate the Chimney Rock Archaeological Area as a national monument, which would be managed by the USFS. Such a designation would provide for the long-term protection and recognition of these significant resources.

The planning area is situated at the boundaries of two distinct physiographic and cultural areas: the Rocky Mountains and the Colorado Plateau. Native Americans associated with the two cultural areas have lived on, or traversed through, the lands within the planning area for thousands of years. They hunted, fished, gathered plant foods, farmed, buried their dead, and conducted religious ceremonies on these lands.

The 26 Native American tribes and pueblos maintain active interests in the planning area (Table 3.16.1). Individual tribal members occasionally use public lands to gather plants or other native materials, and to hunt. Consultation efforts with these groups are ongoing. The tribes and pueblos have expressed concerns over the preservation and protection of specific archaeological sites. The Hopi have identified Falls Creek as an area of traditional interest to them. Ethnographic sources indicate that Hesperus Peak in the La Plata Mountains is considered sacred by the Navajo. To date, none of these sites have been formally established as Traditional Cultural Properties.

Table 3.16.1: Tribes and Pueblos with Cultural Ties or Interests in the Planning Area

Tribe/Pueblo		
Southern Ute Indian Tribe	Pueblo of Isleta	Pueblo of Sandia
Ute Indian Tribe (Uintah and Ouray Reservation)	Pueblo of Jemez	Pueblo of Santa Ana
Ute Mountain Ute Tribe	Pueblo of Laguna	Pueblo of Santa Clara
Navajo	Pueblo of Nambe	Pueblo of Kewa
Jicarilla Apache Tribe	Pueblo of Picuris	Pueblo of Taos
Hopi Tribes	Pueblo of Pojoaque	Pueblo of Tesuque
Pueblo of Zuni	Pueblo of San Felipe	Pueblo of Zia
Pueblo of Acoma	Pueblo of San Ildefonso	Pueblo of Ysleta del Sur
Pueblo of Cochiti	Pueblo of Ohkay Owingeh	

Cultural Chronologies

Paleoindian Stage (11,500–5550 B.C.): The Paleoindian stage represents immigrants to the New World who adapted to the environmental changes occurring at the end of the Pleistocene. Based on Paleoindian artifacts, hunting appears to have been the dominant form of subsistence, although in some environments gathering may have played a more significant role. Within the planning area, there are 13 Paleoindian sites recorded on BLM lands and 25 Paleoindian sites recorded on NFS lands.

Archaeological evidence of Paleoindians is limited within the study area. Still, current studies (cf. Pitblado 1993) maintain that there was a significant Paleoindian occupation within southwest Colorado, particularly associated with the Plano complex. Pitblado (1993) notes that not only are Paleoindian sites likely at higher elevations than archaeologists have looked in the past, but they may be under much deeper strata (i.e., Quaternary fill deposits) than normally recorded or researched through surface observation. More excavation and testing of these deposits for potential Paleoindian sites are needed in order to better understand their subsistence and settlement patterns (including the level of seasonal use of the area).

Archaic Stage (6400–400 B.C.): The Paleoindian stage transitioned into the Archaic stage, with a shift to a broader subsistence pattern. This pattern was characterized by an increased reliance on smaller animals, more varied projectile point types, an increased focus on gathering plant resources, and the construction of more labor-intensive, long-term habitation structures and pits. These traits may be spread over a slightly smaller geographic area than many of the Paleoindian complexes. There was a significant Archaic population in the planning area. Within the planning area, there are 211 Archaic sites recorded on BLM lands and 179 on NFS lands.

Early Archaic (6500–3500 B.C) Pioneer Period (6400–4500 B.C.): The Early Archaic is generally characterized by stemmed projectile points, side scrapers, and large bifacial knives. There may have been a population increase toward the end of the period (Duke 1998). Reed and Metcalf (1999) describe the Pioneer period as a time when Paleoindian populations became more sedentary, adopting seasonal settlement patterns.

Middle Archaic (4500–1500 B.C.) Settlement Period (4500–2500 B.C.)/Transitional Period: During the Middle Archaic, there was an apparent increase in population in the area, as well as the introduction of post-holed temporary dwellings. Generally speaking, the Settlement period represents more localized and predictable settlement locations, especially during the winter months. Daub architecture also developed at this time. Many of the traits of the Settlement period are still present in the Transitional period. During the Transitional period, populations may have become more seasonal in their utilization of resources found at higher elevations and slightly less sedentary, and they exhibited greater variability in their material culture (Reed and Metcalf 1999). These behavioral characteristics coincided with a population shift from higher to lower elevations, as the overall temperature rose sometime between 2000 and 1500 B.C. (Lipe et al. 1999). This shift marks the beginning of the Late Archaic.

Late Archaic (1500–500 B.C.) Terminal Period (1000–400 B.C.): In the southern Colorado River Basin, the Late Archaic saw a general reduction in mobility (Lipe et al. 1999:105). The reduced mobility coincided with maize use, as early as 1000 B.C., although a maize-based subsistence system did not develop until much later. In the northern Colorado River Basin, the Terminal period populations began to use the bow and arrow, processed more seed, and may have even experimented with maize horticulture, although perhaps to a lesser extent than populations to the south (Reed and Metcalf 1999).

Formative Stage (1000 B.C.–A.D. 1300): In southwest Colorado, the Formative stage marks the beginning of established maize, bean, and squash agriculture. This time was also characterized by less mobility and more sedentary settlement patterns, demonstrated by the use of permanent habitation structures. Hunting was accomplished using bow and arrow technology. Ceramics were manufactured during this time, as were maize-grinding implements and woven textiles. Within the planning area, there have been 538 Formative stage sites recorded on BLM lands and 1,700 on NFS lands. The Fremont and Ancestral Puebloan cultures are both Formative and exhibit these traits.

Fremont Tradition (A.D. 200–1500): Within the northern Colorado River Basin, Fremont sites are generally characterized by varying degrees of reliance on horticulture, as well as on four other characteristics: distinct coiled pottery, one-rod-and-bundle basketry, deer or mountain sheep moccasins, and a trapezoidal, anthropomorphic style of rock or clay figurines. Of these, the pottery is the most diagnostic of a Fremont site. This is due to its durability. The ceramics are more clearly associated with open artifact sites than with rock art (Reed and Metcalf 1999).

Basketmaker II (1000 B.C.–A.D. 500): Within the planning area, the highest concentration of Basketmaker II sites is in the vicinity of Durango. These sites sometimes appear more characteristic of the Navajo Reservoir Basketmaker occupation than other Basketmaker occupations within the region. In general, Basketmaker II characteristics across the southern Colorado River Basin include the use of maize and maize-grinding implements (with deeper basins than used previously by forager groups); the use of deer, elk, and mountain sheep; and later, some use of plain, coiled brown ware pottery. However, most sites outside the Durango area have no evidence of pottery and can be difficult to distinguish from Late Archaic and even Protohistoric Ute sites. The habitations from this period are typically shallow pithouses with slab-lined cists and beehive-shaped storage units. Site locations appear to be most common along bluffs and benches, and in rock shelters near ecologically diverse zones (Duke 1998).

There appear to be relatively few documented Basketmaker II sites within the planning area; however, there are difficulties with identifying these sites by surface inspection and survey methods alone. Many of these sites may have been assigned to the Archaic period by the original recorder (Lipe et al. 1999:152). In order to rectify this situation, excavation, testing, diagnostic artifact re-evaluation, and general research are priorities in order to refine the characteristics of Basketmaker II sites within the planning area.

Basketmaker III (A.D. 500–750): The Basketmaker III period is generally marked by the introduction of bow and arrow technology (Lipe et al. 1999:143). There is also evidence of the widespread use of maize and squash and the introduction of beans, as well as a corresponding decrease in hunting and the use of wild plants. Some of the habitations were utilized throughout the year, and the archaeological record reflects more activity areas associated with the habitations. Pithouses evolved, becoming gradually deeper and losing the antechamber. Some storage rooms were partially aboveground, and there was an increased number of storage features to accommodate more stored food (Duke 1998; Lipe et al. 1999). Chapin gray ceramics appeared early, followed by Chapin black-on-gray and Sambrito brown/utility wares. Both trough and slab metates were used during this period. Many Basketmaker III sites have been located near farmable land and pinyon-juniper woodlands, as well as on terraces or benches near rivers and other water sources (Lipe et al. 1999).

Basketmaker III sites have several distinctive characteristics; however, their small middens and mostly buried elements make it quite difficult to identify these sites through surface examination alone. For sites with subterranean habitations, subsurface testing and excavation are the best ways to identify and research these occupations (Lipe et al. 1999). With few Basketmaker III sites in the planning area having undergone testing or excavation, it is clear that more research is necessary.

Still, increased Class III survey coverage would undoubtedly shed light on the community and landscape level use of the area by Basketmaker III and other occupations.

Pueblo I (A.D. 750–900): Pueblo I sites represent a period when populations increased from around 2,000 to more than 4,000 people, distributed over nearly 2,000 square miles of southwest Colorado (Lipe et al. 1999). The habitations were occupied on more of a year-round basis than during the previous period; however, long-term residential occupations were still relatively short. Farming became such an important part of life that households were located close to arable lands. Communities with stockaded settlements became more prevalent than under the previous period, as did surface storage and surface habitation structures (Duke 1998; Lipe et al. 1999). Technological changes are evident in ceramics and projectile points. Pottery styles included plain gray ware, neckbanded, Piedra black-on-white, and Rosa black-on-white. Even some red-on-orange and black-on-red vessels are represented in the ceramic traditions for this period (while projectile points were thinner and side-notched) (Duke 1998:9; Lipe et al. 1999).

The field house was an architectural element that arose during this period. Although not likely used extensively until the Pueblo II and III periods, the presence of this architectural feature demonstrates increased intensification of agriculture, and its importance in the subsistence patterns of the people of this period and later. The unit pueblo was also developed during this period. The great kiva was also introduced, which represented a change in social organization (Lipe et al. 1999).

Pueblo I sites are fragile and they are deteriorating at a rapid rate (Lipe et al. 1999). In order to better protect and understand this period, more Class III block surveys, as well as testing and excavation, are needed in order to better understand the dynamics of the Pueblo I occupation of the planning area.

Pueblo II (A.D. 900–1150): The Pueblo II occupation of the southern Colorado River Basin began with a low population density, which gradually increased only to decline again toward the end of the period. Reed and Metcalf (1999) speculate that a small number of Pueblo II groups entered the northern Colorado River Basin during periods of population paucity (although site characteristics are too atypical to easily type the known sites or identify possible sites). Most of the existing recorded Pueblo II sites are situated within the southern Colorado River Basin. Chimney Rock Great House is an excellent example of a Pueblo II Chacoan Outlier.

Pueblo III (A.D. 1150–1300): The Early Pueblo III period (A.D. 1150–1225) is notable for a general population decline, then for a late dramatic population increase. Sites of the period became larger and aggregated into large mesa-top villages, with towers and some “great houses” incorporated into their community centers. Other archaeological evidence characteristic of Pueblo III is the production of Dolores and Mesa Verde corrugated wares, and McElmo and Mesa Verde black-on-white wares. Grooved stone axes were abundant, and triangular projectile points lacking stems are most notable (Lipe et al. 1999).

By the Late Pueblo III period (A.D. 1225–1300), populations continued to aggregate into large community centers. However, unlike previous periods, the people congregated into multi-story cliff dwellings or complexes near canyon rims and springs. Great houses were phased out, and tower complexes became more common. There was a rapid population decline at the end of the period, with a migration of area inhabitants to the southeast and southwest.

The Pueblo III period has been the most studied and researched; therefore, it generates more research questions. Although survey data are always helpful, more significant methods for answering research questions include excavation, testing, and climate studies, as well as more detailed analysis

of data and collections from the Pueblo III period. As an additional consideration, large communities from this period left a highly visible footprint on the landscape and exhibit massive, often still-standing architecture (including towers and cliff dwellings).

Protohistoric (A.D. 1300–1880): The Protohistoric is also called the Post-Puebloan by Lipe et al. (1999). The northern Colorado River Basin context protohistoric stage only includes Ute occupations, while the southern Colorado River Basin discusses Ute and Athabaskan (Navajo and Apache) peoples. Within the planning area, there are 62 Protohistoric sites recorded on BLM lands and 137 Protohistoric sites recorded on NFS lands.

Protohistoric Ute (A.D. 1300–1881): The Ute were the primary occupants of much of Colorado throughout the Protohistoric and historic stages, until historic Euro-American settlement. Unfortunately, the archaeological and early historical records of these peoples have been the least studied and understood. It should not be surprising, then, that the southern Colorado River Basin has no chronological sequence for discussing Ute occupation of the area. In the northern Colorado River Basin; however, more studies have been conducted and a basic chronology has been developed. This chronology is split into two phases by Reed (1988) and Reed and Metcalf (1999), the Canalla phase and the Antero phase.

The overall characteristics of the Protohistoric Ute are often considered an “extension” of the Archaic lifestyle. This similarity can make it difficult to distinguish sites from these two time periods. Ute subsistence, however, focused more on foraging than collecting, and their settlement patterns reflect their preference for high residential mobility over the logistical mobility of the Archaic groups (Reed and Metcalf 1999). Still, this is a differentiation that is often difficult to discern, except, perhaps, through excavation or a more intensive analysis of surface manifestations than has been done to date.

Protohistoric Navajo (A.D. 1485–1760): Similar to cultural remains of the Ute, little archaeological evidence points to a firm date for the first Navajo occupation of southwest Colorado. Oral traditions from modern Navajo groups detail an emergence from the San Juan Mountains. Hesperus Peak (Dibe nitsaa) is sacred and marks a portion of traditional Navajo boundaries (Lipe et al. 1999). Based on oral tradition, the Navajo occupation of the area started around A.D. 1485. Most Protohistoric Navajo sites in southwest Colorado likely date back prior to A.D. 1750, although some date to before A.D. 1700 (Lipe et al. 1999).

Problems associated with identifying both Navajo and Ute sites from the Protohistoric and historic periods are numerous. Material culture from Navajo, Ute, and Archaic contexts exhibit similar manifestations and infer similar functions. These peoples occupied and utilized similar environments and, sometimes, even the same landscapes. The later Ute and Navajo used much of the same material culture that Euro-Americans did, such that the cultural affiliation of artifact scatters can be difficult to distinguish. One of the biggest problems is the general lack of excavated Navajo and Ute sites within the planning area. Testing and excavation of sites, analysis of collected artifacts, and ethnographic overviews of the Navajo and Ute within the planning area are needed in order to increase the understanding of sites from this period.

Historic (A.D. 1630–1950): In spite of its obvious presence across the landscape of the planning area, the historic period is sorely understudied and even undervalued relative to the prehistoric period (Duke 1998). Historic archaeologists and historians need to conduct research on historic sites before the integrity and history of these sites are lost.

Historic Ute (A.D. 1640–1950): Prior to Euro-American contact, the Ute consisted of at least six bands that occupied portions of what is now Colorado: the Muache, Capote, Weminuche, Uncompahgre, Parasunuch, and Yampa. After Ute and Euro-American contact, a treaty was signed in 1863 that was intended to move the Ute to a reservation (so settlers could move in). After this treaty failed, the size of the reservation was reduced by the Treaty of 1868, which gave the settlers more land and more access to minerals in the mountains. Tension continued to build between the Ute and Euro-American settlers and miners. In 1873, the Brunot Agreement was signed, which moved the Ute to lands away from the San Juan Mountains. By 1881, all Utes had been moved out of western Colorado onto reservations in Utah or southern Colorado. Bands descended from the Muache and Capote were moved to the Southern Ute Reservation. Bands descended from the Weminuche were moved to the Ute Mountain Ute Reservation (Duke 1998; Husband 1984; O'Rourke 1980). Although these reservations were significantly reduced by 1934, each has now increased its size by purchasing surrounding lands (Duke 1998; O'Rourke 1980). The current limitation of Ute territory should not preclude archaeologists and managers from seeking archaeological evidence of these people within their former territories.

Historic Euro-American (A.D. 1660–1950): This portion of the chronology encompasses the history of all ethnic groups, other than Native Americans, who occupied the planning area. There are eight general themes represented within the planning area: 1) exploration, 2) mining, 3) transportation, 4) agriculture, 5) logging and lumber industry, 6) recreation and tourism, 7) federal activity, and 8) socio-cultural developments. Within the planning area, there are 512 historic Euro-American sites recorded on BLM lands and 773 historic Euro-American sites recorded on NFS lands.

Trends

Within the planning area, heritage and cultural resources are currently facing numerous impacts from natural and human disturbances. Over the last 10 years, the San Juan region has experienced unprecedented growth and development. This trend is expected to continue and increase. Growth and development may impact non-renewable heritage and cultural resources, both directly and indirectly. Direct impacts may include disturbance from construction, vandalism, and excessive or inappropriate visitor use. Indirect impacts may include accelerated erosion and visual impacts to cultural landscapes. Once these resources are destroyed, they are lost forever. Implementation of the standards and guidelines, oil and gas stipulations, and the objectives for heritage and cultural resources as outlined in the LRMP should help reduce these impacts to heritage and cultural resources.

In addition to impacts from natural and human disturbances, there is a trend for decreasing USFS and BLM budgets while, at the same time, workloads are increasing. This trend hampers the ability to conduct a proactive heritage and cultural resource program. In order to help address the increasing impacts and decreasing budgets, there is a trend toward increasing opportunities for greater public participation and partnerships in heritage and cultural resources management. The goal of these partnerships is to instill a sense of ownership in visitors and to conduct proactive preservation, research, education, and interpretative projects. This is identified as a high priority goal for heritage and cultural resources in the LRMP.

Use Categories

BLM planning and manual guidance stresses the importance of meeting specified goals through the allocation of all cultural properties within the planning area into defined "use categories," based on their nature and relative preservation value.

Sites located on BLM lands have been allocated to the following use categories (some sites have been allocated to more than one use, and 693 sites are unallocated).

- **Scientific Use:** Under this category, sites would be preserved until research potential is realized (592 sites).
- **Conservation for Future Use:** Under this category, sites would be preserved until conditions for use are met (44 sites).
- **Traditional Use:** Under this category, there would be long-term preservation of sites (0 sites).
- **Public Use:** Under this category, there would be long-term preservation and on-site interpretation (7 sites).
- **Experimental Use:** Under this category, sites would be protected until used (3 sites).
- **Discharged from Management:** Under this category, sites would be removed from protective measures (608 sites).

Sites may be placed into more than one use category. For example, a prehistoric site with little or no scientific value may be placed under a discharged from management category, but may also, however, be useful under the experimental use category. Similarly, a historic site may be placed in the public use category, but may still require stabilization and preservation efforts and, therefore, warrant placement under the conserve for future use category as well.

Priority Heritage Assets

Priority heritage assets are those USFS heritage assets that are, or should be, actively maintained. In order to be considered a priority heritage asset, an asset must meet one or more of the following criteria:

- The significance and management priority of the property is recognized through a special designation (e.g., listing on the NRHP or State Register of Historic Properties).
- The significance and management priority of the property is recognized through prior investment in preservation, interpretation, and use.
- The significance and management priority of the property is recognized in an approved management plan.
- The property exhibits critical deferred maintenance needs, and those needs have been documented.

The SJNF and TRFO are in the process of designating priority heritage assets.

3.16.3 Environmental Consequences

Direct and Indirect Impacts

Under all of the alternatives, the heritage/cultural resource program would provide support to all resource projects, as required by Section 106 of the NHPA. Prior to any federal undertaking within the planning area, the SJNF and TRFO must consider impacts to heritage and cultural resources. Under all of the alternatives, the preferred management strategy for eligible sites would be to avoid and protect these sites from direct, indirect, and cumulative effects. Eligible sites are non-renewable resources, and they would lose integrity, heritage value, and potentially important information if they were destroyed or altered. Measures would continue to be implemented in order to avoid the impacts

to sites under federal jurisdiction. Treatments designed to minimize or mitigate adverse effects to eligible properties may include project relocation, redesign or modification, physical protection measures (including fencing or padding), stabilization, restoration, rehabilitation, documentation, monitoring, repair, and data recovery. Any treatment of an eligible site must be consistent with federal standards and other guidelines, policies, and directions.

In addition, under all of the alternatives, the program would include proactive inventory, documentation, analysis, preservation, monitoring, stabilization, research, stewardship, and public interpretation and education.

Generally, adverse impacts may result from ground-disturbing activities that damage archaeological sites or disrupt cultural landscapes (reducing their information potential). Generally, beneficial impacts may result from minimizing or preventing surface disturbance and avoidance of archaeological sites, as well as from measures used to protect sites. There is also a direct relationship between the number of acres disturbed through project implementation and the number of acres surveyed for heritage/cultural sites. This relationship also exists for the number of heritage/cultural sites located and evaluated.

In spite of inventories, the potential exists for undiscovered sites to be exposed and/or damaged by surface disturbance and/or other events. These sites may, or may not, be noticed in time to allow mitigation. This damage would represent an unavoidable adverse impact related to management activities and programs, which may be similar under all of the alternatives.

There would be some irreversible loss of heritage/cultural resources regardless of the alternative selected. Examples include inadvertently damaged or destroyed sites, vandalized or looted sites, and sites undergoing loss from natural processes. Every alternative would seek to minimize this loss through inventory and evaluation, monitoring, preservation and stabilization, research, interpretation, education, and improved project implementation.

It is difficult to measure individual adverse impact components; therefore, the number of acres of ground disturbance may be used as a relative comparison of alternatives. Estimates of disturbance were compiled from the comparison of alternatives (see Chapter 2). Given the enormity of the planning area (more than 2.5 million acres) and the diversity of its landscapes (which results in a wide variability of heritage/cultural site densities, ranging from three sites per square mile to more than 100 sites per square mile), it would be very difficult to make reasonably accurate quantitative assessments of impacts without activity locality information. Therefore, a descriptive, qualitative analysis of the impacts is presented.

Direct impacts may result from natural events, as well as from human activities that can damage heritage resources or alter their settings. Examples may include surface disturbance, soil compaction, erosion, heating and freezing, wildfire, prescribed burns, livestock trampling, OHV use, alteration of a heritage/cultural resource setting and/or landscape (including introduction of atmospheric or audible intrusions), potential loss of protection for undiscovered heritage/cultural resources if land is transferred from federal to non-federal ownership and from unauthorized uses (including looting of artifacts).

Indirect impacts to cultural resource sites are not always as obvious or immediate as direct impacts and may include impacts that occur off-site from project areas. Indirect impacts may include accelerated erosion due to increased traffic, construction, loss or changes of vegetation, and changes in drainage patterns, as well as inadvertent damage from increased visitation to sites not previously accessible and not “hardened” for public use (which may also result in increased vandalism and

removal of artifacts). Projects may also result in piecemeal or incremental loss or degradation of the various elements of integrity such as setting, feeling, association, and location (which includes visual and auditory elements) that may be integral to the cultural landscape and individual site significance. In general, impacts to cultural resources would be managed by applying appropriate surveys and standards and guidelines, and through law enforcement support and education, as appropriate.

Impacts to Heritage and Cultural Resources from Oil and Gas Management

This FEIS ROD would provide a leasing availability decision to identify areas available to oil and gas leasing. There are two additional NEPA review stages that would occur prior to any ground-disturbing activities associated with oil and gas development. The Leasing Availability Decision considers broad areas in the planning area and is not site specific enough to make quantifiable assessments of the impacts to cultural resources. This analysis is therefore qualitative rather than quantitative. Potential specific adverse impacts to heritage and cultural resources related to oil and gas development would be properly addressed under project-specific oil and gas EAs.

Development of oil and gas would involve local areas of earth disturbance (including the well pad, laydown and support areas, access roads, pipelines, and additional support facilities, such as meter stations and water handling facilities). Any earth-disturbing activities may destroy or diminish heritage/cultural resources, as well as the setting and context that are part of their importance. Direct physical impacts to heritage/cultural resources related to the construction and operation of oil and gas facilities may be immediate and irreversible; however, most of these impacts would be avoidable through the Section 106 process. It is expected that these impacts may be localized.

In addition to the general direct impacts described above, indirect physical impacts related to oil and gas development to heritage/cultural resources may also include deterioration of structures or rock art from vibration, dust, or exhaust produced by construction or operation. Erosion and changes to vegetation that result from off-site construction may also change the characteristics and integrity of a site. If the setting and feeling of a site are essential elements of its importance, visual or auditory intrusions or deterioration of the local environment would also constitute indirect impacts to the aesthetic quality of the site. An additional potential indirect impact may result when development of oil and gas access roads makes some areas more accessible to motorized vehicles. This accessibility may result in the potential for more people to visit sites and, thereby, increase the chance for unintentional deterioration or intentional vandalism. This may be mitigated by closing access roads to public traffic.

Over the long term the combined direct and indirect impacts described above may result in a net loss or degradation of heritage/cultural resources. This cumulative effect may be compounded especially as the density and quality of roads is increased in areas that were not previously easily accessed.

It is projected that over the life of the FEIS, 2,930 acres may potentially be disturbed by oil and gas development on lands currently leased. The Leasing Availability Decision in this FEIS/ROD may make additional acres available for disturbance by oil and gas development. These are additional acres are within the PLAA and the San Juan Sag. The PLAA covers a large portion of the western half of the planning area and has a great variety of topographic and environmental settings. This variety of landscapes and resources has resulted in a highly variable archaeological site density that varies from low to high throughout the PLAA. Archaeological sites within the PLAA range in age from Paleoindian to historic, providing a complete record of human occupation in southwest Colorado. Archaic sites are especially prominent in the northern half of the PLAA, a time period that has been little studied in this region and is poorly understood. Portions of the southern half of the PLAA have a moderate to high density of Ancestral Puebloan sites. In general, the San Juan Sag has a low

archaeological site density. The few archaeological sites that have been recorded in the San Juan Sag range in age from Archaic to historic.

The potential acreage to be disturbed by oil on gas development on lands that may be made available for leasing by this FEIS/ROD varies by alternative. The lands proposed for oil and gas leasing under Alternative A could result in an additional 4,430 acres of disturbance, Alternative B could potentially result in an additional 3,873 acres of disturbance, Alternative C could potentially result in an additional 3,150 acres of disturbance, and Alternative D could potentially result in an additional 4,256 acres of disturbance, while the No Leasing Alternative would result in no additional acres disturbed. All ground-disturbing activities would undergo Section 106 inventory, evaluation, and consultation. Avoidance or mitigation measures would be utilized where eligible heritage/cultural resource sites are present. Standard lease terms would apply to all proposed oil and gas exploration and development. In addition to the standard lease terms, Table 3.16.2 outlines the lease stipulations specific to heritage and cultural resources that would be applied by alternative.

Table 3.16.2: Lease Stipulations for Heritage and Cultural Resources

Resource	Alternative A	Alternative B	Alternative C	Alternative D
National Register Districts National Register Districts: Lost Canyon, Spring Creek **Proposed National Register Districts:** Saul's Creek, Peterson Gulch, Turkey Creek, Armstrong Ritter, Mesa Verde Escarpment, Anasazi Culture Area ACEC, Bull Canyon Rock Shelter, and Indian Henry's Cabin	SLT; NSO	NSO	NAL	NSO
Chimney Rock National Monument; Falls Creek Archaeological Area; Anasazi National Register District	NAL	NAL	NAL	NAL
Old Spanish National Historic Trail	SLT	NSO 0.5 mile	NSO 5 miles	NSO 0.5 mile
Viewshed for the Old Spanish National Historic Trail	SLT	CSU	CSU	SLT
Viewshed for the Chimney Rock Archeological Area	SLT	NSO	NAL	CSU
Viewshed for the Glade Guard Station, and Aspen Guard Station	SLT	CSU	NSO	SLT

Comparison of Oil and Gas Development Alternatives:

Under all of the alternatives, impacts to heritage and cultural resources from oil and gas development would be alleviated through identification, avoidance, and/or mitigation. However, a minor amount of direct and indirect impacts may still result during surface-disturbing activities due to unanticipated discoveries of heritage and cultural resources, off-site erosion, and increased access to heritage and cultural resources. Therefore, Alternative A, which authorizes the largest amount of acres to be leased, and consequently disturbed, could result in the largest amount of impacts to heritage and cultural resources. This would be followed by Alternative D, which has the second highest amount of acres to be leased and disturbed by oil and gas activities. Alternative B would have less potential impacts to heritage and cultural resources than Alternatives A or D. Alternative C would have less potential impacts to heritage and cultural resources than Alternative B, while the No Leasing

Alternative would have the least potential impacts to heritage and cultural resources than all of the other alternatives.

Alternative A would also provide for the least amount of protection for cultural resources, as in most instances only standard lease terms apply. The exceptions are Chimney Rock Archaeological Area, the Falls Creek Archaeological Area, and the Anasazi Archaeological District, which are not available for lease, and NSO for Indian Henry Cabin, the Bull Canyon Rock Shelter, and the Anasazi Culture Area ACEC, which are included in existing management plans.

In addition to the lease stipulations specific for heritage and cultural resources outlined in Table 3.16.2, standard lease stipulations and Section 106 of the NHPA would apply to all oil and gas exploration and development. It is, therefore, expected that oil and gas management may have minor direct adverse impacts to heritage/cultural resources. However, given the high site density of some areas within the proposed PLAA, direct impacts to cultural resources may be unavoidable, in which case mitigation of these impacts would have to occur. Mitigation measures could include excavation. While excavation is beneficial as it expands the archaeological knowledge base, it also results in the loss of archaeological resources and is considered an adverse effect under the NHPA. Indirect and cumulative impacts related to oil and gas management may be minor to moderate, especially in areas with high site densities.

Section 106 archaeological surveys and excavations associated with oil and gas development have long been a major contributor to our knowledge and understanding of heritage/cultural resources. This beneficial impact to archaeology and cultural resource management may continue under all of the alternatives.

Under a no new oil and gas leasing scenario the anticipated minor to moderate indirect and cumulative effects to heritage/cultural resources would not occur, which would be an overall positive benefit to these resources. However, the information regarding heritage/cultural resources that is obtained through Section 106 archaeological surveys and excavation associated with oil and gas development would not be gained.

<u>Cumulative Effects to Heritage and Cultural Resources from Oil and Gas Development</u>

Throughout southwest Colorado, past, current, and future oil and gas development has occurred and is projected to continue to occur within areas that have vary from low to high potential for heritage and cultural resources. Due to the lack of specific location data for oil and gas development, it is not possible to make a quantitative analysis of the cumulative effects of this development on heritage and cultural resources. The oil and gas development that has occurred and is projected to occur on federal lands both leased and currently unleased has been and would continue to be subject to the laws and regulations that protect heritage and cultural resources. However, oil and gas development that has occurred and would continue to occur on private lands with private minerals has not been, and would not in the future be, conducted with the above listed protection and mitigation measures. Therefore, cumulative impacts to heritage and cultural resources on private lands/private minerals could be minor to major, especially when oil and gas development is focused on private lands/private minerals to avoid the costs/restrictions associated with federal protection and mitigation measures.

Over the long term the combined direct and indirect impacts described above could result in a cumulative net loss or degradation of heritage and cultural resources as a result of oil and gas development and the lack of protective laws and regulations for private lands with private minerals. All of the alternatives could result in minor to moderate cumulative impacts especially in areas with high potential for heritage and cultural resources.

Cumulative impacts could also occur to heritage and cultural resources as a result of non-sanctioned activities (including vandalism, looting, or illegal excavation). Efforts to control and monitor these activities on public lands would be similar under all of the alternatives and could, therefore, result in a similar minor to moderate level of cumulative adverse impacts to heritage and cultural resources.

Impacts to Heritage and Cultural Resources from Recreation Management

Recreational use of public lands has increased dramatically over the last 25 years and would most likely continue to increase. Recreational use of the planning area may result in unintentional damage to cultural resources that, although individually minor, may result in widespread, adverse impacts through time. Examples of such impact include robbing boards from historic structures for campfires; creating routes through sites (which accelerates erosion); sitting, standing, or climbing on walls; shooting or defacing rock art panels; and collecting artifacts or relocating artifacts by creating "collector's piles." Some forms of vehicle-assisted recreation may damage sites directly or indirectly by accelerating erosion and/or increasing site accessibility for vandalism and looting. Such impacts have been well documented on the SJNF and TRFO and elsewhere. In 2011 there were three incidents of visitors to the ghost town of Animas Forks removing boards from the historic buildings. From 2011 to 2012 there were four incidents of graffiti in the Falls Creek Rockshelters. The Falls Creek Rockshelters contain very significant 2,000-year-old pictographs. The impacts documented in the reports "The Destruction of Archaeological Sites and Data," by Nickens (n.d. [1990]), and "Site Condition and Vandalism Assessment of Archaeological Sites, Lower and Middle Arch Canyon, San Juan County, Utah," by Spangler (2006) are just a couple examples of recreation impacts to heritage and cultural resources that are very similar to those occurring on the SJNF and TRFO. These recreation-related impacts range from minor collector piles to major impacts and loss of archaeological deposits.

Three new SRMAs would be proposed under Alternatives B, C, and D. The existing Silverton SRMA would be greatly expanded in Alternative B, C, and D. In general, managed recreation, as proposed by the SRMAs, would result in less potential impacts to cultural resources than would dispersed, unmanaged recreation. However, these benefits may not be realized if recreational impacts to heritage and cultural resources are not monitored and mitigated (especially if recreational use dramatically and/or unexpectedly increases as a result of focused management).

Historic cultural resources have long been a focus of management in the Silverton SRMA and would continue to be a focus under all of the alternatives. However, as stated above, the projected increased recreation use would require ongoing monitoring, proactive preservation, education, and mitigation of potential impacts (as directed in the *Alpine Loop Cultural Resource Management Plan* [BLM 1992]).

The Durango SRMA would focus on non-motorized recreation (including hiking, mountain biking, and rock climbing). The BLM Class I overview (Collins et al. 2006) identifies Grand View Ridge as an area of high potential for cultural resources. Grand View Ridge would be included in the Durango SRMA. Additionally, three known rock art sites are currently in an established popular rock climbing area within this proposed SRMA. Under all of the alternatives, the development of trails and facilities would take place under Section 106 of the NHPA; therefore, impacts to cultural resources would be avoided or mitigated. The focused recreation management direction provided by the SRMA under all of the alternatives may result in beneficial impacts to cultural resources.

The Dolores River SRMA would focus on river recreation. There are a high number of cultural resources present and river-related use is topographically constrained; therefore, this area would have a high potential for impacts to cultural resources. Sites in this area that are visible from the river

would be especially at risk from camping, frequent visitation, or vandalism. These impacts may be the same under all of the alternatives. As stated above, a directed management approach provided by the SRMA may limit adverse impacts to cultural resources.

The Cortez SRMA would provide motorized and non-motorized recreation. This area contains the Mud Springs Geographic Unit, as identified in the BLM Class I overview (Collins et al. 2006), which is the remnant Anasazi Culture Area ACEC. It would also include the Stinking Springs Geographic Unit. These areas have a high density of significant and sensitive sites. Due to their proximity to Cortez, these areas currently experience a large volume of cross-country OHV use, which can result in extensive direct damage to cultural resources. Indirectly, the use of OHVs may damage or destroy vegetation, inorganic surface crusts, and natural ground cover, and may also result in visual and auditory impacts. Erosion and compaction of soils and alteration of soil stratigraphy may result from motorized recreation. Increased looting and vandalism may also take place. These impacts may result in the loss of site integrity and significance. Such impacts have been well documented within the SJNF and TRFO and elsewhere. An example is MacMillan's (2007) *Mud Springs Travel Management Cultural Resources Inventory Project, Montezuma County Colorado* (SJ07038) report, which documented OHV damage and looting on five archaeological sites within the project area. These impacts ranged from moderate to major and included the destruction of subsurface features, impacts to human burials, and heavy looting.

Under Alternatives B, C, and D, a management plan would be developed for the Cortez SRMA. This plan would designate routes and trails in order to avoid cultural resources and develop monitoring plans and mitigation (if impacts are identified). As stated above, SRMA designation may result in beneficial impacts through more focused management direction. Under Alternatives B and C, Mud Springs would be removed from the SRMA to emphasize protection of the Anasazi Culture Area ACEC. Therefore, Alternatives B and C would provide more protection for these cultural resources.

Comparison of Recreation Management Alternatives: In general, Alternatives B, C, and D may result in similar potential beneficial impacts to cultural resources in the Silverton, Durango, and Dolores SRMAs. The potential benefits would not be realized under Alternative A for these SRMAs, as this alternative does not provide for SRMAs in those areas. A smaller area of the Silverton SRMA would be protected under Alternative A. Alternatives B and C would provide more protection for cultural resources, as the Anasazi Cultural Area ACEC would be removed from the Cortez SRMA

Under all the alternatives, recreation may have a minor to moderate impact on cultural resources in the Silverton SRMA due to the highly visible and fragile nature of its historic resources and the potential for unauthorized recreational impacts in this remote area. Under Alternatives B, C, and D, recreation may have a minor impact to cultural resources in the Durango and Dolores SRMAs due to unauthorized recreational impacts and unanticipated discoveries during the Section 106 process. Recreation may have a minor to moderate impact to cultural resources in the Cortez SRMA under Alternatives A and D, again due to unauthorized recreational impacts and unanticipated discoveries during the Section 106 process. Alternatives B and C could provide more protection for cultural resources in the Cortez SRMA, as the Anasazi Cultural Area ACEC would be removed from the SRMA under these alternatives.

Impacts to Heritage and Cultural Resources from Travel Management

OHVs driving over heritage/cultural sites may result in major direct impacts. Indirectly, the use of OHVs may damage or destroy vegetation, inorganic surface crusts, and natural ground cover. OHV use may also result in visual and auditory impacts. Erosion and compaction of soils and alteration of soil stratigraphy may result from motorized recreation. Increased looting and vandalism may also take

place. These impacts may result in the loss of site integrity and significance. These impacts have been well documented in the SJNF and TRFO and elsewhere. MacMillan's (2007) report mentioned above notes these types of impacts. Wise's (2010) *Cultural Resource Inventory of the Beaver Meadows and Sauls Creek Landscape Travel Management Route Designation Project, La Plata, Archuleta and Hinsdale Counties, Colorado* also documents similar impacts. Impacts from OHVs that caused erosion, damage to artifacts, and collection of artifacts have ranged from minor to major. Motorized travel over snow may result in negligible, if any, impacts to heritage/cultural resources.

Implementation of the 2005 travel management regulations and the 2012 Colorado Roadless Rule would greatly reduce the impacts to heritage/cultural resources by directing motorized travel to designated routes. Travel on designated routes may still have the potential to directly and indirectly impact heritage/cultural resources that have not been avoided or hardened for such use. Designation of specific travel routes would be developed under a travel management plan, which would require a separate NEPA process from this LRMP/FEIS. As part of that separate NEPA process, impacts to heritage/cultural resources on BLM lands within the planning area would be addressed in accordance with *Addendum 1 to the Colorado Protocol: Section 106 Requirements for Comprehensive Travel and Transportation Management Planning*.

Comparison of Travel Management Alternatives: This FEIS identifies areas that are suitable for over-ground and oversnow travel by alternative. Alternatives B and C would designate the largest amount of acreage as not suitable for over-ground motorized travel; therefore, these alternatives may have the least potential to impact heritage/cultural resources. Alternatives A and D would designate the largest amount of acreage as suitable for motorized travel; therefore, the potential for ground disturbance and impacts to heritage/cultural resources may be the highest under those alternatives.

Impacts to Heritage and Cultural Resources from Fire and Fuels Management

Wildfires and prescribed burns have the potential to directly impact heritage/cultural resources (by burning wooden historic and prehistoric structures and damaging or destroying flammable artifacts and features of archaeological sites, such as wickiups, tepee poles, tree platforms, and brush game drives). Non-flammable artifacts, such as lithic materials, may be impacted by high-intensity fires. Rock art may also be damaged by fire and smoke. Activities carried out under emergency situations in order to control a wildfire (including the construction of firelines) may also directly damage heritage/cultural resources. Indirect impacts related to fire include post-fire erosion losses resulting from burned vegetation cover and hydrophobic soils, deterioration and weathering after the artifacts and features are initially damaged by extreme temperatures, changes in the landscape adjacent to heritage/cultural resources, and looting and vandalism due to increased site visibility. These types of impacts have been well documented within the SJNF and elsewhere. (See Duke et al. [2003] and Buenger [2003] for local examples of these impacts, and Ryan and Jones [2003], and BLM [1998] for regional examples of these impacts.) Overall effects from fire and fuels management to heritage and cultural resources can range from minor to major loss of resources.

Impacts would tend to be greater in wildfire situations than they would for prescribed burns because of extreme fire temperatures, an inability to control the impacts, and because it would be almost impossible to plan inventories of heritage/cultural resources in advance. Some inventories may be conducted during the construction of firelines. Impacts related to fire may be determined, and appropriate mitigation measures may be carried out if a complete inventory of the burned area is conducted shortly after the fire has been controlled. This is not, however, always possible. Therefore, potentially significant impacts related to wildfire may remain undetermined under the alternatives. The number of heritage/cultural resources impacted by wildfire on an annual basis cannot be predicted.

Mechanical fuels treatments would have the potential to directly impact heritage/cultural resources. This is because they may result in moderate to high amounts of ground disturbance and mixing of soils. This would especially be the case if tracked vehicles were used on wet soils. Mechanical fuels treatments may also masticate features such as wickiups, tepees, and brush corrals. However, most of these impacts would be avoidable through the Section 106 process. Indirect impacts may include erosion and changes to vegetation that result from off-site projects, which may change the characteristics and integrity of a site. Sites that are avoided and left as “leave islands” within fuels treatment project areas may be more vulnerable to looting and vandalism (because they can be easily identified and targeted). There is some evidence that under the correct conditions, fuels treatments such as “hydro-mulch” may have a beneficial impact to heritage/cultural resources because they may reduce erosion and act as a protective cover. Hazardous fuels reduction may also be beneficial to heritage/cultural resources by providing “defensible space” for resources such as rock art and wooden structures that are especially vulnerable to the impacts related to wildfire.

Comparison of Fire and Fuels Management Alternatives: Section 106 inventories, evaluation, and consultation would be completed on the all areas proposed for prescribed burn or other fuels treatments. These areas would be approximately the same under all of the alternatives; therefore, potential impacts to heritage/cultural resources may be the same under all alternatives. These impacts are expected to be minor. This is because all identified significant heritage/cultural resources would be avoided or mitigated; however, there would still be the potential for unanticipated discoveries during the Section 106 process and the potential for increased looting of “leave islands.” Location information for these fuels treatments is not yet available; therefore, it is not possible to estimate the number of heritage/cultural resources that may be potentially impacted.

Alternative A calls for a reduced amount of wildfire use acres; it would therefore have less unanticipated/uncontrollable impacts to heritage and cultural resources from wildfire use than the other alternatives. Wildfire is unpredictable; therefore, the potential impacts to heritage/cultural resources are not quantifiable and may range from negligible to major. Cultural resource fire constraint maps for each Ranger District/Field Office identify prescriptions for individual sites, site types, and archaeologically sensitive areas. These maps are referred to in the event of wildfire.

Impacts to Heritage and Cultural Resource from Livestock Grazing

The impacts of livestock grazing on cultural resources varies due to non-uniform grazing patterns that reflect differences in terrain, forage abundance and preference, soil attributes, and archaeological site distribution. Livestock grazing (especially where animals congregate to drink water or consume minerals, where they shelter under rock overhangs, and/or where they use pathways and stock trails) may result in impacts to heritage/cultural resources in those areas. The stratigraphic soil layers that are very important in establishing cultural chronologies may be churned and distorted by livestock digging, movements, and congregation. Areas were livestock concentrate are often located near springs, rock shelters, cliff faces, drainages, and forest edges—the same areas that are important to humans prehistorically and historically. Cattle may also damage standing prehistoric and historic structures and rock art through rubbing and trampling. Grazing impacts to heritage and cultural resources have been well documented across the western United States. In response to the Comb Wash Decision (1993), the BLM and the USFS have implemented policies to identify and mitigate these impacts (e.g., BLM IM No. CO-2002-029 “Interim Historic Preservation Guidelines and Procedures for Evaluating the Effect of Rangeland Management Activities on Historic Properties” (BLM 2002c); the 2007 Programmatic Agreement Between the U.S. Department of Agriculture, Forest Service, and the Advisory Council on Historic Preservation, Regarding Rangeland Management

Activities on National Forest Service Lands (USFS 2007c); and the 2008 Standard Range Recission Strategy for Cultural Resources, San Juan National Forest (USFS 2008).

Typical of the impacts identified as a result of these policies were those described in *Environmental Assessment of #CO-036-99-014 Tomichi Allotment Management Plan & Grazing Permit Reissuance for Tomichi Allotment #06319* (BLM 1999). This EA reported, “Ten of the need data sites and nine of the eligible sites have been severely impacted by historic grazing practices. Such impacts occurred around heavily utilized areas such as springs, salt lick localities, and along fence lines. These impacts include displacement and breakage of artifacts, and accelerated erosion which not only impacted the integrity of the sites, but also contributed to increased looting” (Coleman 2000:10). Impacts from livestock grazing may be direct, indirect, and cumulative, and may result in minor to major impacts.

Impacts of range-related activities (including fence construction, spring developments, wells, stock tanks, pumps, pipelines, water storage, and cattle guards) and non-structural projects (including noxious weed treatments, forage improvements, and mineral supplementation) may have the potential to alter or destroy heritage/cultural resources. These activities would be considered undertakings, and would, therefore, undergo Section 106 inventory, evaluation, and consultation. Avoidance or mitigation measures would be utilized where eligible heritage/cultural resource sites are present. Under all of the alternatives, a cultural assessment (as outlined in BLM IM CO-2002-029: *Interim Historic Preservation Guidelines and Procedures for Evaluating the Effect of Rangeland Management Activities on Historic Properties* [BLM 2002c] and *Standard Range Recission Strategy for Cultural Resources* [USFS 2008d]) would be necessary in order to assess the impacts related to grazing.

Comparison of Livestock Grazing Alternatives: Alternative D would propose the most acres suitable for livestock grazing and may, therefore, have the most potential to result in impacts to cultural resources, followed by Alternatives A and B, which may result in similar impacts. Alternative C may have the least potential to result in impacts to heritage/cultural resources. Under all of the alternatives impacts are expected to be minor because all identified significant heritage/cultural resources would be avoided or mitigated. However, there would still be the potential for unanticipated discoveries during the Section 106 process. There is also the possibility that erosion caused by past and current grazing practices may result in additional unanticipated impacts.

Impacts to Heritage and Cultural Resource from Solid Minerals Management

Solid minerals management includes both locatable and salable minerals. Locatable minerals include mining of precious and base metals, and locatable uranium and vanadium. Locatable mineral mining is a statutory right and is not discretionary. However, locatable mineral regulations require that mining activities result in no undue or unnecessary degradation. Salable minerals include the mining of gravel, stone quarries, and collection. Salable minerals are discretionary when the land management agency owns the mineral rights. When private mineral rights are involved, management is less discretionary.

Solid minerals management has the potential to damage or destroy heritage/cultural resources through major ground-disturbing and construction activities related to exploration, mining, milling, and the development of ancillary facilities (including waste rock piles, mill tailings, roads, and loading facilities). Many of the areas with the potential for locatable minerals were mined historically for precious and base metals, as well as for uranium and vanadium. Many of these historic mining/milling sites are now eligible for listing on the NRHP. Gravel operations have the potential to damage or destroy archaeological sites, including buried archaeological sites that have no surface artifacts or features. Stone collection has the potential to damage sites (including prehistoric and historic stone

masonry structures, stone game drives, and stone alignments). Mining of both locatable and salable minerals has the potential to indirectly impact heritage/cultural resources as the result of cultural landscape alterations, and visual and auditory intrusions, as well as changes to vegetation that result from off-site projects (which could alter the characteristics and integrity of a site).

Under all of the alternatives, precious and base metals, uranium, and vanadium mining may have a high potential to impact historic mining resources. Salable mineral management may have a moderate potential to impact heritage/cultural resources. Federal land management agencies are responsible for ensuring that Section 106 inventory, evaluation, consultation, and, if necessary, avoidance or mitigation occurs prior to authorizing solid minerals projects.

Comparison of Solid Minerals Management Alternatives: Overall, the potential impacts related to solid minerals management on heritage/cultural resources may be the same under all of the alternatives. Impacts are expected to be minor because all identified significant heritage/cultural resources would be avoided or mitigated; however, there would still be the potential for unanticipated discoveries during the Section 106 process.

Impacts to Heritage and Cultural Resources from Timber Management

Timber harvesting activities may impact heritage/cultural resources as the result of surface disturbance caused by machinery and vehicles, by the felling trees on certain types of sites, the skidding of logs, theft or vandalism caused by workers, or erosion from vegetation removal or damage. In addition, fuels and oils used by heavy equipment may be spilled or dumped on heritage/cultural sites. Construction or reconstruction of permanent or temporary roads associated with timber sales may have the potential to impact heritage/cultural resources as the result of damage or destruction of areas directly impacted. Construction of roads may also have the potential to result in indirect impacts to heritage/cultural resources (by making sites more accessible). This accessibility may increase the chances for incidental deterioration or vandalism. As noted above, under all of the alternatives, eligible sites would be avoided or mitigation of impacts would occur though the Section 106 process.

Comparison of Timber Management Alternatives: Alternative D may have the greatest potential to impact heritage/cultural resources. This is because it would propose the highest amount of ground-disturbing activities, followed by Alternatives A and B. Alternative C would have the lowest amount of proposed road construction and timber treatment; therefore, it may have the least impact on heritage/cultural resources. Under all of the alternatives, impacts are expected to be minor because all identified significant heritage/cultural resources would be avoided or mitigated; however, there would still be the potential for unanticipated discoveries during the Section 106 process.

Impacts to Heritage and Cultural Resources from Lands and Realty Management

Lands and realty actions may acquire surface and subsurface estate, which would bring the estate under federal protection and, thereby, benefit heritage and cultural resources. Withdrawals restrict certain activities (such as mining and access), which, in turn, decreases uses and visitation. This may also directly benefit heritage and cultural resources. Depending on the size and location of the withdrawal, this could have a negligible to major beneficial effect to heritage and cultural resources.

Land disposals have the potential to remove heritage and cultural resources from federal jurisdiction. However, any land disposal would be subject to the laws and regulations that protect heritage and cultural resources and any potential impact to heritage and cultural resources would be mitigated.

However, due to the loss of federal ownership, mitigation of prehistoric resources for land disposals can be very expensive and is considered an adverse effect under the NHPA; it may also be regarded as an unnecessary negative impact by Native Americans to their traditional and cultural properties. There is also the possibility that unexposed and thereby unknown heritage and cultural resource could inadvertently be disposed of. Again, depending on the size and location of the land disposal, this could have a negligible to moderate impact to heritage and cultural resources.

Surface-disturbing activities authorized by the lands and realty programs (including ROWs and communication sites) may result in adverse direct and indirect impacts to heritage and cultural resources. However, these actions would be subject to the laws and regulations that protect heritage and cultural resources and any potential impacts to heritage and cultural resources would be mitigated. Therefore, impacts may be negligible to minor.

Comparison of Lands and Realty Alternatives: The potential impacts related to lands actions on heritage and cultural resources may be similar under Alternatives A, B, and D, as these alternatives provide for close to the same amount of lands to be disposed of. Alternative C would have the least potential to impact heritage and cultural resources. This is because several parcels have been removed from the list of lands available for disposal in Alternative C due to the presence of known archaeological sites eligible for the NRHP in the those parcels.

Under all of the alternatives identified, significant heritage/cultural resources would be avoided or mitigated; however, there would still be the potential for unanticipated discoveries during the Section 106 process. Therefore, impacts to heritage and cultural resources from lands and reality actions may be negligible to moderate.

Impacts to Heritage and Cultural Resources from Cultural Resource Management

As stated above, under all of the alternatives cultural resources would continue to be protected under Section 106 of the NHPA. The heritage/cultural resources program would conduct proactive NHPA Section 110 inventory, documentation, analysis, preservation, monitoring, stabilization, research, stewardship, and public interpretation and education under all of the alternatives. While excavation is beneficial because it expands the archaeological knowledge base, it also results in the loss of archaeological resources and is considered an adverse effect under the NHPA.

Comparison of Cultural Resource Management Alternatives: Alternatives B and C would provide the most proactive management and, therefore, may result in the most beneficial impacts to heritage/cultural resources. This is because these alternatives would propose the establishment of two additional special management areas—McPhee and Mesa Verde Escarpment—that are not included under the other alternatives. Under these alternatives, McPhee and Mesa Verde Escarpment would be managed specifically for their outstanding heritage/cultural resource values and for their recreational/interpretive/educational opportunities. These MAs would not be included under Alternatives A or D.

Alternatives A, B, and C would provide additional proactive management of heritage/cultural resources. This is because these alternatives would retain the Anasazi Culture Area ACEC (which was established in the previous BLM San Juan/San Miguel Resource Management Plan). This ACEC was established in order to protect significant prehistoric archaeological resources. This ACEC has a multitude of competing uses, including mineral materials and recreation. The acreage of the ACEC under Alternatives B and C has been slightly reduced to avoid these competing uses without

eliminating any significant cultural resources. Retention of the ACEC under Alternatives A, B, and C would ensure a greater level of focused management and protection of cultural resources.

Cultural resource management under Alternatives B and C may result in the greatest benefits to heritage and cultural resource due to the proposed establishment of the greatest number of protective MAs. This would be followed by Alternatives A and then D.

Cumulative Impacts

Over time, cumulative impacts to heritage/cultural resources may include the loss of sites, or parts thereof (prior to the development of better preservation methods and research techniques), the loss of interpretive values, and the incremental loss of the heritage/cultural resource base.

Past actions that have contributed, cumulatively, to impacts on cultural resources include livestock grazing and vegetation management, mineral development, recreation, looting and vandalism, and ongoing natural erosion. These negative factors are present outside, as well as inside, the planning area.

Prior to Section 106 of NHPA, many activities occurred on public lands with no regard for the protection of heritage and cultural resources. Activities such as vegetation treatments using chains or harrows drug large pieces of equipment across the ground surface in order to remove trees and shrubs. This, along with other mechanical treatments, undoubtedly destroyed numerous archaeological sites within their path. The development of many mines, roads, railroads, timber sales, and campgrounds within the planning area took place prior to Section 106 protection requirements, and untold numbers of archaeological sites were undoubtedly destroyed or disrupted. Thousands of cattle and sheep grazed the public lands with no limitations or regulation from the 1870s up to the 1940s causing extensive resource damage and erosion, which also caused major impacts and loss of archaeological resources.

Loss of heritage and cultural resources on private lands within the planning area has been extensive in the past and is ongoing. “Arrowhead hunting” and “pot hunting” have a long been a favorite recreational and commercial pastime in southwest Colorado. The selling of “Anasazi” pots and artifacts has been a lucrative source of income for over 120 years. Although the Antiquities Act, Archaeological Resource Protection Act, and Native American Graves Protection and Repatriation Act prohibit this on public lands, looting still continues on public lands and is ongoing on private lands, which is only regulated by Colorado State law that prohibits the disturbance of human remains. There has also been a tremendous loss of Ancestral Puebloan sites due to the development of farming, towns and residences in the Great Sage Plain in the southern and western portions of the planning area. Past developments on private and public lands have resulted in major cumulative impacts to heritage and cultural resources.

Current and future land management projects may result in additional surface disturbance and may bring additional people in contact with heritage/cultural resources, which could also lead to additional impacts to those resources. Under the different alternatives, differences in cumulative impacts to heritage/cultural resources would be the result of sanctioned management activities. It is anticipated that overall these impacts would be minor due to the protection and mitigation measures that would be implemented. Alternatives A and D would have the highest projected amounts of development and, therefore, may have the highest potential to impact heritage/cultural resources. Alternatives B and C would provide for a more proactive management of heritage/cultural resources with the establishment of the McPhee and the Mesa Verde Escarpment Special Management Areas. Alternatives A, B, and C would retain the remnant Anasazi Culture Area ACEC and would thereby

provide more administrative protection for the heritage and cultural resources located within the ACEC. Alternative C and the No Leasing Alternative call for the least amount of development and would therefore result in the least amount of projected impacts to heritage and cultural resources. The additional inventory and evaluation that may occur under all of the alternatives may lead to more heritage/cultural resources being located, and a potential reduction of adverse cumulative impacts caused by natural processes after heritage/cultural resources are brought under appropriate management (assuming sufficient funding and personnel are available). An additional benefit would be increased knowledge and understanding of heritage/cultural resources. Oil and gas management and fuels management are large contributors to the inventory and evaluation of heritage/cultural resources.

Current and future impacts may also occur to heritage/cultural resources on public lands as a result of non-sanctioned activities (including vandalism, looting, or illegal excavation). Efforts to control and monitor these activities would be similar under all of the alternatives and therefore may result in a similar minor to moderate level of cumulative adverse impacts to heritage/cultural resources. Under Alternatives A and D, there would be less emphasis on controlling and monitoring non-sanctioned activities at McPhee and Mesa Verde Escarpment and, therefore, they may have a greater potential for cumulative impacts. However, under Alternatives B and C, efforts to control and monitor non-sanctioned activities would be more proactive at McPhee and Mesa Verde Escarpment; therefore, the cumulative impacts are expected to be less under those alternatives.

Cumulatively, heritage/cultural resources on federal lands may assume greater importance because such resources on private lands are not provided the same degree of protection. Projects in and around the planning area funded by the federal government are subject to federal requirements for protection of heritage/cultural resources. Construction and development on private land may destroy heritage sites without providing an opportunity for recovery of data or other mitigation. Therefore, it is believed that cumulative impacts to heritage resources on private lands are much greater than on federally administered lands. In essence, federal lands have become the major “repository” of heritage and cultural resources in the region, making the preservation and protection of these resources even more important.

3.17 Paleontological Resources

3.17.1 Introduction

The term ‘‘paleontological resource’’ means any fossilized remains, traces, or imprints of organisms, preserved in or on the earth’s crust, that are of paleontological interest and that provide information about the history of life on earth, except that the term does not include:

(A) any materials associated with an archaeological resource (as defined in Section 3(1) of the Archaeological Resources Protection Act of 1979 [16 USC 470bb(1)]; or

(B) any cultural item (as defined in Section 2 of the Native American Graves Protection and Repatriation Act [25 USC 3001]).

Fossils convey the story of history of life on earth including the evolution and extinction of marine, freshwater, and terrestrial organisms.

Legal and Administrative Framework

Paleontological (fossil) resources are natural resources that occur on public lands; therefore, they are managed in accordance with the requirements of federal laws, primarily the Paleontological Resources Preservation Act of 2009 (PRPA) and NEPA (see below). These laws apply similarly to both BLM and NFS lands, although FLPMA is also applicable to BLM lands. Additional requirements for the collection, preservation, and protection of paleontological resources on applicable federal lands would be addressed in forthcoming federal regulations currently being promulgated. The BLM currently has specific manual guidance (i.e., IM 2008-009 [BLM 2008], IM 2009-011 [BLM 2009b], Manual 8270).

Laws

- **The Mineral Materials Act of 1947:** This act allows the protection of petrified wood on public lands.
- **The Petrified Wood Act of 1962 (PL 87-713):** This act excludes exclude deposits of petrified wood from appropriation under U.S. mining laws.
- **The National Environmental Policy Act of 1969:** NEPA covers the policy for documentation of effects (impacts) of federal actions on natural resources on public lands, including paleontological resources.
- **The Federal Land Policy and Management Act of 1976:** FLPMA substantially amends the Forest and Rangeland Renewable Resources Planning Act of 1974. This act strengthens the references pertaining to suitability and compatibility of land areas, stresses the maintenance of productivity, and seeks to avoid the permanent impairment of the productive capability of the land.
- **The Federal Cave Resources Protection Act of 1988:** This act serves to secure, protect, and preserve significant caves on federal lands for the perpetual use, enjoyment, and benefit of all people, and to foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on federal lands for scientific, education, or recreational purposes.
- **The Paleontological Resources Preservation Act of 2009:** The PRPA directs the Secretaries of Agriculture and Interior to manage and protect paleontological resources on NFS lands using scientific principles and expertise. Through this act the USFS and BLM are currently developing appropriate plans for inventory, monitoring, and the scientific and educational use of paleontological resources, in accordance with other applicable agency laws, regulations, and policies. These plans will emphasize interagency coordination and collaborative efforts where possible with non-federal partners, the scientific community, and the general public. Agencies are continuing to use existing policies while new regulations are being drafted.

Regulations and Policies

- **36 CFR 228.62: Free Use (e) – Petrified Wood.** On NFS lands, this addresses free-use permits that may be issued to amateur collectors and scientists to take limited quantities of petrified wood for personal use. As such, petrified wood in most instances is managed as a minerals material rather than a paleontological resource. In rare instances, deposits of petrified wood that are more appropriately managed as paleontological resources under the PRPA can be designated as such by the Authorized Officer.
- **36 CFR 291:** This will contain rules promulgated under PRPA.

- **43 CFR 37:** This addresses the protection of significant caves and cave resources, including paleontological resources.
- **43 CFR 8365:** This addresses the collection of invertebrate fossils and, by administrative extension, fossil plants.
- **43 CFR 3622:** This addresses the free-use collection of petrified wood as a mineral material for non-commercial purposes on BLM-administered lands.
- **43 CFR 3621:** This addresses the collection of petrified wood for specimens exceeding 250 pounds in weight.
- **43 CFR 3610:** This addresses the sale of petrified wood as a mineral material for commercial purposes.
- **43 CFR 3802 and 3809:** These address the protection of paleontological resources from operations authorized under the mining laws.
- **43 CFR 8200:** This addresses procedures and practices for the management of lands that have outstanding natural history values, including fossils, which are of scientific interest.
- **43 CFR 8365.1-5:** This addresses the willful disturbance, removal, and/or destruction of scientific resources or natural objects and Subpart 8360.0-7 identifies the penalties for such violations.
- **Secretarial of the Interior Order 3104:** This grants the BLM the authority to issue paleontological resource use permits for lands under its jurisdiction.
- **FSM:** Policy for management of paleontological resources on NFS lands forthcoming.
- **BLM Manual 8270:** This outlines policy for the management of paleontological resources. With this are updates from BLM Washington Office Internal Memoranda dated post-1998, such as the Potential Fossil Yield Classification (PFYC) and mitigation updates.
- **BLM IM 2012-140 (BLM 2012c):** Collecting Paleontological Resources Under the Paleontological Resources Preservation Act of 2009
- **BLM IM 2012-141 (BLM 2012d):** Confidentiality of Paleontological Locality Information Under the Omnibus Public Lands Act of 2009, Title VI, Subtitle D on Paleontological Resources Preservation

The PRPA stipulates the management of paleontological resources on applicable federal lands using scientific principles and expertise. This direction emphasizes interagency coordination and collaborative efforts where possible with non-federal partners, the scientific community, and the general public. Paleontological resources are managed for scientific, educational, and recreational values, and to protect or mitigate paleontological resources from adverse impacts. To accomplish this goal, paleontological resources are identified and evaluated by qualified paleontologists, and paleontological information is considered in the decision-making process commensurate with other natural resources in accordance with NEPA.

The USFS is developing manual direction for the management of paleontological resources on NFS lands. Previous to the PRPA, collection of paleontological resources on NFS lands was regulated only by 36 CFR 261.9(i), which prohibits “excavating, damaging, or removing any vertebrate fossil or removing any paleontological resource for commercial purposes without a special use authorization.” With the forthcoming passage of new USFS regulations (36 CFR 291), the 261.9(i) clause would be abolished.

A classification system called the Fossil Yield Potential Classification (FYPC) was developed by the USFS Paleontology Center of Excellence and the Region 2 Paleo Initiative in 1996, although this system was never formally institutionalized by the USFS. In 2008 the BLM instituted a variation of this system under the title of Potential Fossil Yield Classification (BLM IM 2008-009). Predictive modeling systems for the occurrences of paleontological resources provide baseline guidance for assessing the relative occurrence of important paleontological resources and the need for mitigation. Geologic units are classified at the formation or member level, according to the probability of yielding paleontological resources of concern to land managers. Historical classifications such as the Fossil Yield Potential Classification and PFYC are founded upon the likelihood of geologic units to produce “significant” paleontological resources. On NFS lands, managers only need be concerned if paleontological resources are present or absent, and if present then an assessment and management recommendation is undertaken. (See Volume III, Appendix B, for a description of the current PFYC system in place for the BLM).

3.17.2 Affected Environment

Existing Conditions and Trends

Paleontological resources are integrally associated with the geologic rock units (e.g., formations) in which they are located. Particular geologic units with high probability for the occurrence of paleontological resources should be managed accordingly. Within the planning area, various geologic units have differing potentials to contain paleontological resources. Other areas may also contain paleontological resources, but have not been examined and evaluated. The potential for paleontological resources is currently evaluated through the use of the PFYC system, although an alternative system of paleontological resource categorization in geologic units is under development by the USFS paleontology program. No comprehensive survey of paleontological resources has been conducted in the planning area. The need for paleontological resource assessment is handled on a case-by-case basis in consultation with a qualified paleontologist.

In 1899, Walter Granger of the American Museum conducted the first paleontological work in the area. Since that time, scientific investigation has been sporadic. A great deal of the area is remote, and many of known paleontological resources have been reported by the general public.

Known and Potential Paleontological Resources

Known paleontological resources found within the planning area are dominantly Jurassic and Cretaceous in age, and include various plants (often petrified wood, leaf impressions), invertebrates, and vertebrates (including dinosaur and mammal remains). Various Paleozoic and Tertiary aged rocks within the planning area may also contain unrecognized paleontological resources. Much of the planning area has not been surveyed for paleontological resources, and therefore the extent of paleontological resources is unknown. Noteworthy fossil occurrences within the planning area include:

- San Jose Formation (Paleocene vertebrates – mammal bones)
- Mancos Shale (invertebrates including ammonites, pelecypods, oysters, and gastropods; vertebrates including shark teeth and fish scales, rare occurrences of bony fish and marine reptile remains)
- Dakota Sandstone (leaf and wood impressions, dinosaur tracks, and vertebrate and invertebrate ichnofossils)

- Dolores (flowering plants)
- Morrison (Late Jurassic dinosaur bones and skeletons, invertebrates)
- Chinle (late Triassic vertebrate fauna including aetosaur, metoposaur, phytosaur, and archosaur; also fish and plant remains)
- Navajo Sandstone (diversity of tetrapod tracks including early mammals, dinosaurs, pterosaurs, crocodylians, reptiles, and invertebrate traces; petrified wood; dinosaur bone).

Perhaps above all other geologic units, the Morrison Formation is renowned for high potential to produce dinosaur bones and skeletons. The Morrison Formation is also the focus of past and current vanadium and uranium mining on public lands and DOE leases; therefore, there exists the potential need for future focused assessments of the Morrison Formation. Examples of known Morrison Formation localities producing dinosaur remains on the SJNF include the Horse Range Mesa Locality (BLM) and the McPhee Reservoir Sauropod Locality (USFS) currently being managed in partnership with Mesa State College, Grand Junction, Colorado.

In accordance with the PRPA, paleontological resources within the planning are subject to the following direction regarding collection and curation:

- A paleontological resource may not be collected from federal land without a permit issued by the land managing agency. Casual collecting is allowed without a permit on federal land controlled or administered by the BLM or USFS, where such collection is consistent with the laws governing the management of those federal lands and the PRPA. The term ‘‘casual collecting’’ means the collecting of a reasonable amount of common invertebrate and plant paleontological resources for non-commercial personal use, either by surface collection or the use of non-powered hand tools resulting in only negligible disturbance to surface and other resources. The terms “reasonable amount” and “negligible disturbance” would be defined as part of the forthcoming regulations.
- Any paleontological resource, and any data and records associated with the resource, collected under a permit, shall be deposited in an approved repository.
- Safeguards against incompatible land and resource uses may be imposed through withdrawals, area closures, stipulations on leases and permits, design requirements, and similar measures developed and recommended by an appropriately staffed interdisciplinary team.

Due to recreational activity, minimal localized degradation of geologic features, including their contained paleontological resources, is expected to continue. Exposed paleontological resources may be degraded by casual OHV and mountain bike use that occurs off of existing or established routes.

The condition of paleontological resources would likely improve through the availability of public education and awareness program (per the PRPA, Section 6303). Permitting research collection is necessary for the responsible conservation of paleontological resources.

3.17.3 Environmental Consequences

Direct and Indirect Impacts

Federal undertakings and unauthorized uses have the potential to result in irreversible disturbance and damage to non-renewable paleontological resources. The SJNF and TRFO would continue to

mitigate impacts to paleontological resources resulting from authorized uses through avoidance, redesign, and specimen recovery. Geologic units with exposures containing paleontological resources may continue to be impacted as the result of natural agents, unauthorized public use, mining, and vandalism.

The current positive and/or negative impacts related to casual collection of common invertebrate and plant paleontological resources is unknown. Applications for research and collection of paleontological resources on the SJNF are relatively few in number.

Management measures common to all alternatives would preserve and protect paleontological resources for present and future generations. Adverse impacts would be mitigated by avoidance, recordation, or collection by a qualified paleontologist.

Under all of the alternatives, the risks of damage or destruction of paleontological resources could result from mining of vanadium/uranium, unauthorized activities (including dispersed recreational activity, OHV use, vandalism, unauthorized collection), and natural processes of weathering. Under all of the alternatives, unquantifiable indirect impacts may occur. Wilderness areas, WSAs, and other special designation area management may reduce access to paleontological resources, as would the management of rivers for the ORVs identified for suitable WSR designation.

Impacts to paleontological resources within the planning area may result from actions proposed under the following resource management programs that have the potential to disturb fossil-bearing geologic formations: minerals development; prescribed fire, fire suppression efforts and fuels management; recreation; lands and reality actions; and travel management.

Impacts to Paleontological Resource from Minerals Development

Uranium/Vanadium Exploration and Development Impacts

Uranium and vanadium are locatable minerals under the 1872 Mining Law and 43 CFR 3809. These minerals are often found in geological formations with a high potential for vertebrate fossils. Surface-disturbing activities authorized by the mining laws and regulations (including mineral exploration projects and extraction of mineral resources) may result in adverse direct and indirect impacts to paleontological resources. Agency management options for protecting resources during exploration of these minerals under these laws and regulations are limited and have short time frames. Therefore, the potential for direct and indirect effects to paleontological resources during exploration for uranium and vanadium may range from minor to major. Agency management options for protecting resources during development/extraction of uranium and vanadium under these laws and regulations is somewhat broader and potential impacts may be minor to moderate. Potential impacts would be mitigated through assessment for paleontological resources, avoidance, and/or collection and recordation to minimize impacts to acceptable levels.

Oil and Gas Development Impacts

Oil and gas development may disturb geologic formations containing paleontological resources. Disturbances may result from direct (e.g., well pad excavation, road building, pipeline construction) or from indirect impacts resulting from increased accessibility of paleontological resources by the construction of access roads and increased off-site erosion. Potential adverse impacts to paleontological resources related to oil and gas development would be properly addressed under project-specific oil and gas EAs. Under all of the alternatives, prior to the approval of an APD, identified areas of disturbance must be assessed for the likelihood of containing paleontological resources and appropriate mitigation measures employed as warranted. If a locality containing

paleontological resources could not be avoided, the area would have to be properly mitigated through collection and recordation. These protections would be provided for in the PRPA, the paleontology guidance provided above, and the standard terms and conditions of all oil and gas leases. In addition to the these protections, the Horse Range Mesa Paleontological Locality is protected through an NSO stipulation in Alternatives A, B, and C, and a CSU stipulation under Alternative D. This NSO includes an exception criterion for permitted paleontological excavation in order to recover important paleontological resources. Even with these protections, it is expected there would be a minor effects to paleontological resources due to unanticipated direct and indirect effects, such as discovery of fossils during pipeline construction, off-site erosion, and looting.

<u>Comparison of Alternatives</u>

Uranium and Vanadium Exploration and Development: The exploration and development of uranium and vanadium is regulated by the 1872 Mining Law and 43 CFR 3809. Impacts to paleontological resources from these activities would be the same under all alternatives. Paleontological surveys and excavations performed as a result of uranium/vanadium mining plans of operation could be major contributors to the knowledge and understanding of paleontological resources. This beneficial impact to paleontological management could result under all of the alternatives.

Oil and Gas Development: Under all of the alternatives impacts to paleontological resources from oil and gas development would be mitigated through identification, avoidance, and/or collection and documentation. However, a minor amount of direct and indirect impacts may still result during surface-disturbing activities due to unanticipated discoveries of paleontological resources, off-site erosion, and increased access to paleontological resources. Therefore, Alternative A, which authorizes the largest amount of acres to be leased and consequently disturbed, could result in the largest amount of impacts to paleontological resources. This would be followed by Alternative D, which has the second highest amount of acres to be leased and disturbed by oil and gas activities. Alternative B would have less potential impacts to paleontological resources than Alternatives A or D. Alternative C would have less potential impacts to paleontological resources than Alternative B; while the No Leasing Alternative would have the least potential impacts to paleontological resources than all of the other alternatives.

Alternatives A, B, and C would provide the most protection for the Horse Range Mesa Locality with an NSO stipulation for oil and gas leasing. Alternative D would provide the least amount of protection for the Horse Range Mesa Locality with a CSU stipulation. Under all of the alternatives, the McPhee Reservoir sauropod area would be provided protection as it is located within the Anasazi National Register District that is not available for lease under all of the alternatives.

Paleontological surveys and excavations performed as a result of oil and gas development could be a major contributor to the knowledge and understanding of paleontological resources. This beneficial impact to paleontological management could result under all of the leasing alternatives.

Impacts to Paleontological Resources from Fire and Fuels Management

Mechanical treatments for fuels management in pinyon-juniper, mixed shrub, and ponderosa pine vegetation communities could result in surface disturbances that could have a negligible to minor impact on paleontological resources. Although most paleontological resources are located within a matrix of bedrock and are not impacted by minor surface disturbances such as being driven over by tracked mechanical equipment, some fossils are more fragile (for example dinosaur eggs and nest

sites); these fragile resources and can be destroyed through even minor surface disturbance and erosion.

Wildland fire use and prescribed burns may result in direct and indirect impacts to paleontological resources. Fire may result in the direct destruction of organic fossil remains (e.g., Quaternary packrat middens). The removal of vegetative cover by fire may accelerate weathering processes, which, in turn, may result in short-term indirect impacts. However, these impacts may be negligible when compared with similar impacts that occur by natural processes. Fire suppression that involves the use of heavy equipment and the construction of firelines would create surface disturbances that may result in direct minor impacts to paleontological resources.

<u>Comparison of Alternatives</u>

Under all of the alternatives, the potential impacts related to fuels management on paleontological resources may be similar. All of the alternatives project the same number of acres of mechanical treatments in pinyon-juniper, mixed shrub, and ponderosa pine vegetation communities; therefore, all of the proposed alternatives could have a negligible to minor impact to paleontological resources from fuels management, most of which would be mitigated through identification, avoidance, and/or collection and documentation.

Alternative A could result in the least amount of potential impacts from wildland fire use and prescribed burns, as this alternative projects the least amount of acres to be burned. Alternatives B, C, and D could result in similar amounts of minor of impacts to paleontological resources from wildland fire use and prescribed burns, as these alternatives all project similar acreages to be burned. Some of these impacts could be mitigated; however, wildland fire situations may not allow time for identification, avoidance, and/or collection of paleontological resources. Therefore, Alternatives B, C, and D may all result in minor impacts to paleontological resources that might not be mitigated.

Impacts to Paleontological Resource from Recreation

Recreational use of public lands has increased dramatically over the last 25 years and would most likely continue to increase. Recreational use of the planning area may result in unintentional damage to paleontological resources that, although individually minor, may result in widespread, adverse impacts through time. Examples of such impacts may include illegal collection of protected paleontological resources and the creation of routes through paleontological localities (which may accelerate erosion). Some forms of vehicle-assisted recreation may damage sites directly or indirectly by increasing site accessibility for vandalism and looting.

Three new SRMAs would be proposed under Alternatives B, C, and D. The existing Silverton SRMA would be greatly expanded in these three alternatives. Under Alternatives B, C, and D, management plans would be developed for all of the SRMAs. These plans would designate routes and trails in order to avoid paleontological resources and develop monitoring plans and mitigation (if impacts are identified). In general, managed recreation, as proposed by the SRMAs, would result in less potential impacts to paleontological resources than would dispersed, unmanaged recreation. However, these benefits may not be realized if recreational impacts to paleontological resources are not monitored and mitigated (especially if recreational use dramatically and/or unexpectedly increases as a result of focused management).

The potential for paleontological resources is very limited within the Silverton SRMA. Potential fossil-bearing geologic formations in this area are restricted to Quaternary gravels and Pennsylvanian

limestones. There would be a negligible to minor potential for recreational gold panners and recreational hikers to impact these paleontological resources.

Geologic formations within the Durango SRMA range from low to high potential for paleontological resources. The Durango SRMA would focus on non-motorized recreation (including hiking, mountain biking, and rock climbing). In general, these activities have a negligible to minor potential to impact paleontological resources. Impacts could include illegal collecting, erosion, and surface disturbance from trail construction.

Geologic formations within the Dolores River SRMA range from variable to high potential for paleontological resources. The Dolores River SRMA would focus on river recreation. Impacts would most likely be limited to illegal collecting and would be negligible to minor.

Geologic formations within the Cortez SRMA range from variable to high potential for paleontological resources. The Cortez SRMA would provide motorized and non-motorized recreation. Impacts could result from illegal collecting and user-created trails, and erosion and surface disturbance from trail use. Due to their proximity to Cortez, these areas currently experience a large volume of cross-country OHV use, which may result in minor to moderate direct damage to paleontological resources. Erosion from motorized recreation may directly impact paleontological resources. Increased looting and vandalism may also take place. These impacts may result in the loss of fossils and locality integrity.

Comparison of Alternatives

Under all of the alternatives, the development of trails and facilities would take place under the PRPA; therefore, impacts to paleontological resources from these activities would be avoided or mitigated. In general, the focused recreation management direction provided by the SRMAs in Alternatives B, C, and D may result in similar potential benefits/impacts to paleontological resources in the Silverton, Durango, Dolores, and Cortez SRMAs. These potential benefits would not occur under Alternative A in the Durango, Dolores, and Cortez SRMAs, as this alternative does not provide for SRMAs in these areas. A smaller area of the Silverton SRMA would be protected under Alternative A. Under all the alternatives, recreation may have a negligible to minor impact on paleontological resources in the Silverton SRMA. Under Alternatives B, C, and D, recreation may have a negligible to minor impact to paleontological resources in the Durango and Dolores SRMAs. Recreation may have a minor to moderate impact to paleontological resources in the Cortez SRMA under Alternatives A and D. Alternatives B and C could provide more protection for paleontological resources in the Cortez SRMA, as the Anasazi Cultural Area ACEC would be removed from the SRMA under these alternatives. Casual recreational collecting (legal) of paleontological resources would continue under all of the alternatives.

Impacts to Paleontological Resource from Lands and Realty Management

Lands and realty actions may acquire surface and subsurface estate, which would bring the estate under federal protection and, thereby, benefit paleontological resources. Withdrawals restrict certain activities (such as mining and access), which, in turn, decreases uses and visitation. This may also directly benefit paleontological resources. Depending on the size and location of the withdrawal, this could have a negligible to major beneficial effect to paleontological resources.

Land disposals have the potential to remove paleontological resources from federal jurisdiction. However, any land disposal would be subject to the laws and regulations that protect paleontological resources and any potential impact to paleontological resources would be mitigated. However,

unexposed and thereby unknown paleontological resource could inadvertently be disposed of. Again, depending on the size and location of the land disposal, this could have a negligible to moderate impact to paleontological resources.

Surface-disturbing activities authorized by the lands and realty programs (including ROWs and communication sites) may result in adverse direct and indirect impacts to paleontological resources. However, these actions would be subject to the laws and regulations that protect paleontological resources, and any potential impact to paleontological resources would be mitigated. Therefore, impacts may be negligible to minor.

Comparison of Alternatives

The potential impacts related to lands actions on paleontological resources may be similar under all of the alternatives. Under all alternatives, site-specific paleontological surveys would provide for site avoidance of potential fossil-yielding formations, thereby providing a means to identify and avoid disturbance to fossil sites. Therefore, impacts to paleontological resources from lands and reality actions may be negligible to moderate

Impacts to Paleontological Resources from Travel Management

OHVs driving over paleontological resources may result in minor to major direct impacts. Indirectly, the use of OHVs may damage or destroy vegetation, inorganic surface crusts, and natural ground cover. Erosion that has the potential to expose fossils and/or accelerate their deterioration may result from motorized recreation. Increased looting and vandalism may also take place. These impacts may result in the loss of fossils and locality integrity. Motorized travel over snow may result in negligible, if any, impacts to paleontological resources.

Implementation of the 2012 Colorado Roadless Rule would greatly reduce the impacts to paleontological resources by directing motorized travel to designated routes. Travel on designated routes may still have the potential to directly and indirectly impact paleontological resources that have not been avoided or hardened for such use. Designation of specific travel routes would be developed under a travel management plan, which would require a separate NEPA process from this LRMP/FEIS.

Comparison of Alternatives

This LRMP/FEIS identifies areas that are suitable for over-ground and oversnow travel by alternative. Alternatives B and C would designate the largest amount of acreage as not suitable for over-ground motorized travel; therefore, these alternatives may have the least potential to impact paleontological resources. Alternatives A and D would designate the largest amount of acreage as suitable for motorized travel; therefore, the potential for ground disturbance and impacts to paleontological resources may be the highest under those alternatives.

Cumulative Impacts to Paleontological Resources

Cumulative Effects from Minerals Development

Effects from Uranium and Vanadium Exploration and Development: Since the turn of the twentieth century, uranium and vanadium exploration and development has been very active throughout western Colorado. The major boom in uranium and vanadium mining occurred in the 1940s and 1950s. During this period there was little concern for resource impacts, including impacts to paleontological resources. Prospectors often targeted petrified trees and dinosaur bones for

exploration and development of uranium and vanadium mines, as it was well known that these fossils were exceptionally rich in uranium and vanadium. Untold thousands of paleontological resources were most likely lost during this period. A second boom in uranium and vanadium mining occurred during the 1970s and 1980s. Nascent resource protection laws were implemented with varying success during this period, which also resulted in additional losses of paleontological resources. A large percentage of current uranium and vanadium exploration and development is occurring on lands leased to the DOE. As a federal agency, the DOE is also required to implement the protections provided by the PRPA on the mining operations it oversees. The next largest percentage of current uranium exploration and development is occurring on lands managed by the BLM and USFS. A very small percentage is occurring on privately owned lands. At this point it is hard to quantify the amount of future exploration and development as uranium and vanadium mining are tied to energy, defense, and industry, which are very much in flux at this time.

When assessing past, current, and future effects to paleontological resources, it is evident that past uranium and vanadium exploration and development had the greatest impacts by far to these resources. Overall, cumulative effects to paleontological resources from uranium and vanadium exploration and development have been major. However, with the implementation of current federal laws and regulations to protect paleontological resources, it is expected that current and future impacts from uranium and vanadium development to paleontological resources on public lands would only be minor contributors to the cumulative effects to these resources.

Cumulative Effects from Oil and Gas Development: Throughout southwest Colorado, past, current, and future oil and gas development has occurred and is projected to continue to occur within geological formations that have variable to high potential for paleontological resources. The exception to this is the San Juan Sag, which has a low potential for paleontological resources. Due to the sparse locality information currently available for paleontological resources and the lack of specific location data for oil and gas development, it is not possible to make a quantitative analysis of the cumulative effects of this development on paleontological resources. The oil and gas development that has occurred and is projected to occur on federal lands, both leased and currently unleased, has been and would continue to be subject to the laws and regulations that protect paleontological resources. The recent passage of the PRPA would further enhance these protective measures. However, oil and gas development that has occurred and would continue to occur on private lands with private minerals has not been, and would not in the future be, conducted with the above listed protection and mitigation measures. Therefore, cumulative impacts to paleontological resources on private lands/private minerals could be minor to major, especially when oil and gas development is focused on private lands/private minerals to avoid the costs/restrictions associated with federal protection and mitigation measures.

Over the long term the combined direct and indirect impacts described above could result in a cumulative net loss or degradation of paleontological resources as a result of oil and gas development and the lack of protective laws and regulations for private lands with private minerals. All of the alternatives could result in minor to moderate cumulative impacts especially in areas with high potential for paleontological resources. This range of impacts is due to the variability of topography and exposures of fossil-bearing outcrops within the projected areas of oil and gas development.

Cumulative impacts could also occur to paleontological resources as a result of non-sanctioned activities (including vandalism, looting, or illegal excavation). Efforts to control and monitor these activities on public lands would be similar under all of the alternatives and could, therefore, result in a similar minor to moderate level of cumulative adverse impacts to paleontological resources.

Cumulative Effects from Other Resources

Past activities such as road building, facility development, and ROW development most likely resulted in major impacts to paleontological resources on public and private lands in southwest Colorado. Prior the passage of laws and regulations that provided for the protection of paleontological resources, there was little consideration of the potential impacts from such actions both authorized and unauthorized to these resources on federal lands. Past and current ground disturbance on private lands has occurred and most likely would continue to occur with little to no consideration of the impacts to paleontological resources.

Fossil “hunting” has long been a popular recreational activity on both public and private lands. While some recreational (non-commercial) collecting of common non-vertebrate fossils is permitted on federal lands, collecting of non-common fossils and vertebrate fossils is prohibited. Prior to the enactment and enforcement of the laws prohibiting the collection of non-common and vertebrate fossils there most likely was a substantial loss of these resources. Unauthorized OHV use off designated roads and trails most likely has resulted in moderate impacts paleontological resources in the past, both on federal and private lands. While these impacts currently are and would continue to be avoided or mitigated on public lands, these impacts would most likely continue to occur to paleontological resources on private lands.

There may continue to be unmitigated impacts to paleontological resources associated with unauthorized activities within the planning area (including OHV use, dispersed recreation, vandalism, and unauthorized collection) and natural processes. Actions authorized by this LRMP/FEIS should have negligible to minor impacts to paleontological resources, as the PRPA and related regulations, handbooks, and policy guidance provide for the identification, avoidance, or collection and documentation of paleontological resources prior to any ground-disturbing activities. Therefore, the actions authorized by this LRMP/FEIS should not contribute substantially to past and future cumulative effects to paleontological resources.

3.18 Lands and Special Uses

3.18.1 Introduction

Special use permits, ROW grants, easements, and leases authorize the occupancy and use of BLM and NFS lands by government agencies, private individuals, or companies for a variety of activities, including roads, dams, pipelines, and other private or commercial uses that cannot be accommodated on private land. Annually, the SJNF and TRFO administer more than 1,000 non-recreational land use authorizations.

The land use permit program also authorizes the occupancy of public lands for pipelines, communication lines, power transmission lines, and communication sites. In order to minimize disturbance, agency policy is to collocate such uses where feasible. Utility corridors are formally designated in order to provide for such use. On SJNF lands, corridor management must comply with the objectives of the MAs crossed by these corridors, unless a specific exception is identified. TRFO lands are generally available for consideration of these uses at the project-planning level, except where restricted by area-specific direction or within exclusion areas. Where pipeline, electric distribution line, and/or communication system line use cannot be collocated, individual authorizations are issued.

Legal and Administrative Framework

- **Revised Statute 2477 (Act of July 26, 1866: 43 USC 932):** Portion of 1866 mining law that was a Homestead-era federal law in place from 1866 until 1976. It states that “the right of way for the construction of highways over public lands, not reserved for public uses, is hereby granted.” The statute allowed local governments to acquire a property interest in roads and other public highways they constructed across unreserved federal land. Although the 1866 act was repealed by FLPMA in 1976, rights associated with Revised Statute 2477 were preserved. These rights are determined through a process that is entirely independent of the BLM’s or USFS’s planning process.
- **The General Mining Law of 1872:** This act authorizes ROWs across public lands for ditches and roads.
- **The Act to Repeal Timber-Culture Laws of 1891:** This act authorizes ditch easements across public lands and forest reserves.
- **The Organic Act of 1897:** This act states that national forests are established “to improve and protect the forest within the boundaries, for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States.”
- **The Transfer Act of 1905:** This act transfers forest reserves to the USDA.
- **The General Exchange Act of 1922:** This act authorizes land adjustments within USFS boundaries.
- **The Federal Land Policy and Management Act of 1976:** This act updates authority for management, provides general authority for use and occupancy, requires fair market value for use of public lands, and repeals sections of many previous acts.
- **The Colorado Ditch Bill Act of 1986:** This act provides for permanent easements for agricultural water systems in use before 1976 in relation to NFS lands.
- **The Cabin User Fee Fairness Act of 2000:** This act updates the application of fees and other management direction related to recreation residence permittees on NFS lands.
- **The Telecommunications Act of 1996:** This act directs federal departments and agencies to make available (on a fair, reasonable, and non-discriminatory basis) property, ROWs, and easements under their control for the placement of new telecommunications services.

3.18.2 Affected Environment

Existing Conditions and Trends

The lands and realty programs on the SJNF and TRFO are responsible for various aspects of ownership and management. Broad responsibilities of the program for managing lands and special uses include:

- managing all aspects of land ownership (including surveying and monumenting land boundaries, acquiring and disposing of lands, protecting federal lands from trespass, assuring that federal resource programs do not trespass onto adjacent non-federal lands, and recording and managing land ownership and title records);

- managing land use and access (including issuing and administering permits, ROWs, easements, and leases for various land uses, roads, trails, pipelines, utility corridors, communication sites, and facilities); and
- administering withdrawals and administrative closures of federal land in relation to specific uses.

Land Ownership

Public lands in southwest Colorado are intermixed with numerous ownerships including local, state, tribal, and other federal and private lands due to the many ways that land has been acquired historically. Tracts of non-federal land occur throughout the SJNF and TRFO; however, private tracts tend to concentrate in open land areas and along river valleys where settlers homesteaded and where towns were founded. Historic land adjustments sometimes concentrated areas of private land for agricultural or municipal purposes, which involved trading federal land for other private holdings elsewhere or selling federal tracts where there was a public benefit to such action. Patenting of mining claims created complex patchworks of private lands in the Silverton, Dunton-Rico, La Plata Canyon, and Dove Creek areas, leaving small isolated remnants of public lands between the private claims. Erroneous or improper surveying and monumenting of the many federal-private land boundaries created abundant opportunities for accidental, as well as intentional, trespass occupancy and use.

Within the planning area, land exchanges (BLM and USFS), direct sale disposals (BLM), and Small Tracts Act sales (USFS) are used in order to improve land ownership patterns and to resolve trespass situations. Numerous parcels of TRFO lands were identified for eventual disposal in the 1985 San Juan/San Miguel Resource Management Plan. The 1983 San Juan National Forest Land and Resource Management Plan contained a land ownership adjustment plan that identified several parcels of NFS lands for disposal or acquisition by land exchange.

Land acquisition may occur by purchase, exchange, or donation. Purchase is generally funded by the Land and Water Conservation Fund. Land exchanges require an equal exchange of values, in land and cash, and must result in a net public benefit. Donations must meet acceptable public land management purposes.

Public lands policy has trended away from the acquisition of land, except for specific project purposes. Policy has started to favor the disposal of public lands where isolation, adjacent use or development, or lack of public benefit makes the land unsuitable or unmanageable for public land purposes. In terms of land acquisitions, land exchange is the most likely process for the USFS and is a viable option for the BLM.

Over the past 20 years, much of the private land within and adjacent to the SJNF and TRFO has been subdivided for residential and commercial use. Faulty or poorly documented land surveys have left the location of many of these property boundaries in dispute since these lands are surveyed by developers or owners, resulting in instances of trespass. Roads and trails constructed over the last 100 years may also deviate from their granted alignments, or they may lack proper easements where they cross private or federal lands. As more boundary lines are resurveyed, more trespass situations may be discovered. Federal budgets for agency lands programs would likely not be adequate to address all instances of trespass.

Land Use and Access Authorizations

The occupancy and use of public lands by local, state, tribal, and other federal agencies, as well as by private industry and individuals, require an authorization from the agency involved. In 2012, there

were 528 land use authorizations on the TRFO and 606 non-recreation Special Use Permits on the SJNF. Applications for both traditional land uses and new uses are increasing. More people are making use of public lands, and adjacent private land is being developed, which in turn is driving up the demand. In addition, many authorizations that were issued under less strenuous environmental review regulations are being renewed, requiring increased analysis and review. New cost recovery programs would increase the revenue held by local BLM and USFS units from applicants in order to help offset the increasing cost of the programs and the lengthy delays in processing applications for use.

Currently, there are 24 recreation residence cabins located on SJNF lands (the BLM does not permit recreation residences). Permits for recreation residences are issued for 20 years. Under the Cabin User Fee Fairness Act of 2000, policy is not to issue new permits. Current policy is to reissue the existing permits when the current permit tenure expires. There are no plans to designate new summer home groups on the SJNF.

Lack of access to the SJNF and TRFO is a growing concern as adjacent landowners block public access. In addition, some landowners enjoy exclusive use of the public lands adjacent to their property and do not wish to lose that effective ownership by granting access or engaging in land adjustment processes. ROW requests and land exchanges and disposals are often opposed for these reasons.

As former ranching, mining, and homesteading tracts are subdivided and developed, the new owners often want, and expect, a higher level of road access and maintenance than the public lands road system was designed to provide. This demand often includes requests for new roads across public lands in order to access individual private parcels.

Increasing development surrounding the SJNF and TRFO is increasing road use, and, thereby, increasing associated maintenance and improvement costs. Across the SJNF and TRFO, county road agencies are becoming overtaxed and, as a result, are reducing their contribution to the maintenance of these roads. They are also often unwilling to assume jurisdiction over what has effectively changed from a public lands access road to a subdivision or commercial development road. The BLM and USFS are not able to expend public funds in order to provide this improved access. Land managers must balance the access rights granted to in-holding owners with their obligation to regulate road use and protect public investments and resources.

Withdrawals

Public lands may be closed to certain types of use through administrative action based on legal or resource concerns, including protecting threatened and endangered species and avoiding damage to important watersheds. In some cases, federal law requires the closure of lands to specific uses, such as the withdrawal of designated wilderness areas from entry under the Mining Law of 1872 (which allows U.S. citizens to file mining claims). Other withdrawals protect certain resources or reserve land use for federal interests (including the withdrawal under the Federal Energy Regulatory Commission for rivers that could support hydroelectric facilities). The SJNF and TRFO lands and realty programs are responsible for administering these closures and withdrawals, and for periodically reviewing them for continued need or revocation.

Utility Corridors, Major Rights-of-way, and Communications Sites

Major electrical transmission lines are found throughout the planning area, and there are currently two designated corridors. They are the Trans-Colorado Pipeline and the Tri-State Electric Corridors (both

cross the Dolores District). The Trans-Colorado Pipeline Corridor was designated as a corridor in a 1992 amendment to the 1983 San Juan National Forest Land and Resource Management Plan.

In the 1985 BLM San Juan/San Miguel Resource Management Plan, no corridors were designated. The RMP encouraged location of new transmission facilities along previously disturbed routes, as well as the sharing of ROWs for compatible transmission uses.

The West-Wide Energy Corridor Programmatic EIS (DOE and BLM 2008) evaluated utility corridors for inclusion in the nationwide designations authorized by Section 368 of the Energy Policy Act of 2005. Corridors across the planning area were directed to follow the existing corridor of the Trans-Colorado Natural Gas Pipeline. Corridor upgrades were limited to existing facilities (with measures instituted in order to protect unstable slopes and the visual resources related to the San Juan National Scenic Byway as it crosses the Dolores River Canyon and Lost Canyon).

Areas designated as utility corridors would be designed to be compatible with the management goals of the areas through which they pass. Expansion, as well as other actions, would not be approved if they did meet these requirements. The width of the corridors would be specified in the individual facility Special Use Permit or ROW authorization. Corridors would only be designated for transmission lines over 69 kilovolts and for pipelines more than 10 inches in diameter. Pipelines greater than 24 inches in diameter would require concurrence (simultaneous consent) by Congress prior to development. Local distribution lines and smaller pipelines would not be identified as corridors and would normally be operated in conjunction with the existing road system (or with other previously disturbed areas) in order to minimize environmental impacts.

The Trans-Colorado Pipeline Corridor is the only nationwide corridor crossing the planning area that is considered in the nationwide corridor study authorized by Section 368 of the Energy Policy Act of 2005. In relation to the proposed alternatives, the number of corridors would not change.

Oil and gas development in the Paradox Basin and the NSJB would require gathering lines in order to transport product to major transmission pipelines. Increase in existing pipeline capacity or construction of a new pipeline paralleling the Williams or Trans-Colorado Pipeline may be required to transport GSGP and conventional natural gas from the Paradox Basin portion of the planning area. Urbanization of private lands adjacent to major communities may see an increase in electric distribution lines and an upgrade in major transmission lines already in existence.

Electronic Sites and Existing Communication Sites

Electronic sites are areas authorized for the location of facilities for communication by radio, television, microwave, and cell telephone systems. Generally, these sites are at the local topographic high points, depending on maximum line-of-sight. Typically, sites are serviced by electric power lines and access roads. Some site users are individual users (due to space limitations, technical considerations, and/or security issues); other site users lease space in their structure and tower for multiple users. The existing electronic sites within the planning area are listed in Table 3.18.1.

Any additional sites for commercial or agency use would require approval of a site plan. The site plan specifications must comply with visual quality and other resource management objectives. The number of sites would not change by alternative.

Future communication and electronic facilities would be encouraged to use existing sites within capacity and compatibility limits. All facilities would comply with visual resource and scenic standards for the desired future conditions in relation to the different alternatives. The increasing demand for

cellular telephone coverage is increasing demand for cell phone relay towers. Visual concerns over the spread of towers to more and more topographic high points may increase. Older antenna towers are being replaced by higher and/or stronger towers in order to accommodate more shared use and heavier equipment. Better technology is reducing the problem of interference, allowing more collocation of facilities.

Table 3.18.1: Electronic and Communication Sites

Communication Site	Agency	Elevation (feet)
Bayfield Ranger Station	USFS	6,900
Benchmark	USFS	9,264
Caviness Mountain	USFS	10,050
Coal Bank	USFS	10,660
Devil Mountain	USFS	9,922
Dolores- Montezuma County	USFS	7,420
Eagle Pass	USFS	11,880
Eightmile Mesa	USFS	8,176
Escalante	USFS	7,080
Expectation Mountain	USFS	11,680
Grassy	USFS	9,525
Kendall	BLM	13,400
Kennebec	USFS	12,240
Menefee	BLM	8,823
Missionary	USFS	9,860
Oak Brush Hill	USFS	8,623
Pargin	USFS	8,910
Parrott Peak	USFS	11,540
Smelter	BLM	7,725
Spring Creek	USFS	8,870
Storm Peak	BLM	13,053
Tuckerville	USFS	11,640
Yellow Jacket	USFS	8,397

3.18.3 Environmental Consequences

Direct and Indirect Impacts

General Impacts

The following assumptions were used when assessing the impacts to actions or authorizations that fall under the lands and special uses program:

- The BLM and USFS would use voluntary approaches to acquire surface (and mineral) estate.
- Site-specific impacts caused by development of facilities would be assessed in accordance with NEPA using an EA or EIS process prior to approval by the BLM or USFS, and mitigation measures could be required.
- The demand for special use authorizations and ROWs would increase within the life of the LRMP.

- ROW and special use authorization holders may maintain their use and access at their discretion consistent within the terms of their grant or permit.

Land use authorizations would be restricted primarily as a result of decisions related to lands and special uses, terrestrial ecosystems and wildlife, heritage and cultural resources, scenic and visual resources, and travel management.

Impacts from Lands and Special Uses Management

Under all alternatives, the SJNF and TRFO could acquire land dependent on having a willing seller. The USFS has limited opportunity for direct disposal of NFS lands; therefore, most land adjustments involving NFS lands would be by land exchange. This is not expected to vary by alternative. The BLM would continue its land adjustment program with land exchanges, as well as with the sale or exchange of lands specifically identified for disposal. The potential for disposing of BLM lands is highest in Alternatives B and D with 15,327 acres of lands available for disposal, followed by Alternatives A (10,469 acres) and C (8,004 acres). Additional criteria for identifying other lands for disposal are found in the LRMP and would not vary by alternative. Under all alternatives, through cooperation with other landowners, the emphasis would be for improved land ownership and access patterns that benefit private landowners and the public.

The ability of the SJNF or TRFO to issue land use authorizations in localized areas may be limited by the agencies' obligation to respect valid, existing rights, such as mining claims.

General impacts discussed below are quantified based on the acres of land that are restricted with stipulations (avoidance areas) or that are not available (exclusion areas) for various types of ROWs and special use authorizations under each of the alternatives. Future land activity cannot be predicted as to specific location, scale, and timing; therefore, the most reasonable way to estimate the impacts of proposed alternatives on the lands program is to consider the amount of land that is restricted or unavailable for possible use. Table 3.18.2 shows the acres under each alternative where ROWs and special use authorizations would be restricted under avoidance areas or prohibited by exclusion areas.

Table 3.18.2: Avoidance and Exclusion Areas

Avoidance/Exclusion Areas by Agency	Alternative A	Alternative B	Alternative C	Alternative D
SJNF avoidance Acres	1,030,769	787,462	509,497	937,468
TRFO avoidance Acres	37,691	232,351	439,984	273,129
Total Avoidance Acres	**1,068,460**	**1,019,813**	**949,481**	**1,210,597**
SJNF exclusion Acres	514,760	647,263	1,068,710	505,900
TRFO exclusion Acres	68,139	69,659	70,049	56,867
Total Exclusion Acres	**582,899**	**716,922**	**1,138,759**	**562,767**

Allocation of avoidance and exclusion areas under the various alternatives would impact the accessibility of lands for the location of pipelines, transmission lines, communication sites, and other ROWs or special use authorizations. These allocations would also restrict the amount of area in which expansion to accommodate new utilities or electronic sites could occur. Changing the availability and restrictions on utility routing and communication site use would restrict expansion as well. Generally, utility routes and communication sites would be compatible with MA 7 designations on SJNF lands and throughout most areas on TRFO lands, except where prohibited by area-specific direction or allocation of exclusion areas. Prohibiting development of permanent facilities in exclusion

areas, requiring limits or prohibitions on road access, or special stipulations in avoidance areas may place future demand on existing sites or on private land. Under Alternative D, 1,210,597 acres would be within avoidance areas, where land use authorizations such as utility corridors and communications sites can occur but with restrictions, followed by Alternative A, B, and C. Avoidance areas in each alternative encompass lands with wilderness characteristics, the Dolores River Canyon, Mesa Verde Escarpment, Anasazi Culture ACEC, Perins Peak Wildlife Management Area, upper tier CRAs, Falls Creek Archeological Area, SBAs, Chimney Rock National Monument, and VRM II/high SIO areas. Alternative C is the most restrictive in terms of impacts to lands and realty actions with 1,138,759 acres within exclusion areas, followed by Alternatives B, A, and D. Exclusion areas in each alternative encompass WSAs, wild segments of suitable WSRs, MA 1, RNAs, wilderness areas, the Piedra Area, and areas recommended for wilderness designation.

Local utilities would be encouraged to use existing pathways that are generally on lands outside avoidance and exclusion areas. Upgrades to existing corridor locations that do pass through avoidance areas may be allowed. However, they may not accommodate additional linear utility routing needs. Site plans for communication sites would be developed for all existing locations. These site plans would identify compatible uses, visual management criteria, and allowable number of users. Any additional sites for public use would require designation, after appropriate environmental analysis and approval.

Under all of the alternatives, the issuance and administration of land use authorizations would continue to provide for a variety of recreation and non-recreation activities. In general, most land uses may be compatible with most other resource activities, and most impacts to the lands program may be minimized by the use of appropriate design guidelines.

The opportunities for ROW acquisitions would not change by alternative. Under all of the alternatives, the acquisition of access to public lands through easements would be identified in order to serve administrative purposes and public access, with the goal of enhancing the management of the public land resources.

Land withdrawals would not be the direct result of the implementation of any of the alternatives. Recommendations for future land closures and withdrawals are included in the overall LRMP direction, primarily from mineral entry. These recommendations may, or may not, be implemented after separate analysis and decision processes. Therefore, potential impacts are not likely to vary predictably by alternative because the recommendations must be acted upon individually by other authorities and agencies. SJNF or TRFO review and recommendation for continuation or revocation of existing withdrawals would also not be the direct result of implementation of any of the alternatives. Therefore, potential impacts are also not likely to vary by alternative.

Impacts from Terrestrial Ecosystems and Wildlife Management

Impacts to the lands and special uses program from terrestrial ecosystems and wildlife management may be higher costs for authorized uses and activities, and, in some situations, denial of discretionary land uses or land ownership adjustments. Wildlife management activities that trigger these impacts would be primarily related to management requirements under the ESA. The degree of the impacts would depend on approved conservation strategies, critical habitat designations, and BOs that mandate specific management requirements for land uses. These requirements would not be known until specific project proposals are submitted and assessed. Protective measures applied to land uses may also increase costs. Management related to protecting certain soils and plants would also place restrictions on the potential siting of ROWs and other land use authorizations. These restrictions are based on LRMP standards and guidelines and would not vary by alternative.

Impacts from Heritage Management

Requirements to protect heritage resources (including the protection of Native American rights of access and use) may preclude some uses and activities within the planning area and in some situations may prevent discretionary land uses or land ownership adjustments. Required mitigation measures may increase the costs for authorized uses and activities. The measurable indicator of impacts would be tied to the allocation of avoidance and exclusion areas as described above, since areas with heritage resources (such as the Mesa Verde Escarpment and Fall Creek Archeological Area) are included within these restrictive allocations. Based on the number of acres where ROWs are prohibited or otherwise restricted, Alternative C would have the greatest impact on the lands program, followed by Alternatives B, D, and A (see Table 3.18.2).

Impacts from Access and Travel Management

Closing areas to motorized travel or designating areas as unsuitable for motorized use would result in further restrictions on land use authorizations in those areas because they would generally be inaccessible. Motorized travel in the majority of the remaining area of the SJNF and TRFO would be restricted to designated routes, which could limit opportunities for land use authorizations to areas along those designated routes if the authorization required motorized vehicle access for construction, operation, or maintenance (unless administrative access was granted for such purposes). Alternative C would include the most acres of closed and unsuitable areas, and thus be the most restrictive alternative, followed by Alternatives B, D, and A.

Impacts from Scenery and Visual Resource Management

Designating areas as VRM Class II or high SIO would result in restrictions on any required land use authorizations to comply with the objectives for the respective management class, along with any stipulations that might be imposed due to these areas being included within avoidance area allocations. While avoidance areas would not apply to VRM Class III or IV, or moderate, low, or very low SIO, land uses would still need to comply with the applicable scenery objectives/visual management classes. Opportunities for land use authorizations in areas managed as VRM Class I or very high SIO would be prohibited, as these are located within exclusion areas. Areas designated as VRM Class III or IV, or moderate, low, or very low SIO would provide the greatest opportunities for land use authorizations, particularly those that would be noticeable within the landscape. These opportunities would be most available under Alternative A, followed by Alternatives D, B, and C. Alternative C contains the highest acreage within the highest SIO and VRM Classes I and II and would have the greatest impact on lands and special use authorizations, followed by Alternatives B, D, and A).

Cumulative Impacts

Cumulative impacts related to the implementation of any of the alternatives may result from a continuation of the same policy and budget constraints that existed under the previous land management plans, greater demand for uses by the public and other agencies, and the imposition of newer environmental laws and regulations on such uses. Past impacts related to multiple land ownership, poor survey and boundary monumentation, increasing demand for residential and commercial use and access, and increasing costs of processing and administering land use authorizations may be increased by future impacts because most land uses do not disappear, once established, and new land uses would only increase the complexity of managing various land use in the planning area. Because the avoidance and exclusion areas are based on protection of multiple

resource values, expected cumulative impacts would be expected to follow the same pattern by alternative.

Over the next 15 years (which is the timeframe for reasonably foreseeable future cumulative impacts), the annual level of applications for land authorizations within the planning area would be directly tied to demographic changes experienced and projected in southwest Colorado. This is expected to increase over this timeframe, with most authorizations occurring in WUI areas, consistent with current patterns of development.

Acquisition of new access routes would be limited by SJNF and TRFO budgets. The SJNF has identified a number of priority cases needed to provide additional access to NFS lands. Changing public use patterns and needs would add additional cases. There are no other anticipated reasonably foreseeable future actions specific to a particular alternative that would differ between the alternatives for land adjustments and/or ROW acquisitions. The SJNF and TRFO have received expressions of interest in the form of out-year plans and priority lists from land use constituents such as Tri-State Generation and Transmission; however, analysis of these projects would be speculative and they are not considered reasonably foreseeable projects prior to receiving initial applications.

3.19 Minerals and Energy: Fluid Minerals

3.19.1 Introduction

This section documents 1) the affected environment, 2) scenarios for RFD as a result of fluid mineral leasing, and 3) the impacts of the four LRMP alternatives and the No Leasing alternative on leasing and oil and gas development opportunities on the SJNF and TRFO.

Oil and gas (natural gas and CO_2) are defined as leasable minerals under federal law and regulation. The BLM has jurisdiction over management of federal oil and gas resources underlying both BLM and NFS lands, as well as those underlying non-federal surface (split estate) lands within the planning area. The BLM and USFS are joint agencies in this analysis under the 2006 Memorandum of Understanding Concerning Oil and Gas Leasing and Operations (BLM and USFS 2006b).

For BLM public lands and federal leasable minerals under non-federal surface lands, the BLM administers all oil and gas leasing and development activity. The BLM analyzes and makes decisions on leasing availability and discloses impacts in its RMP and EIS. Under the Federal Onshore Oil and Gas Leasing Reform Act of 1987 and implementing regulations at 36 CFR 228 E, the USFS must analyze and make decisions on oil and gas leasing for federal leasable minerals underlying NFS lands. Once the USFS determines what lands are available for leasing and the BLM has adopted the analysis, the BLM may offer the selected NFS lands for lease consistent with those decisions. The ROD for this LRMP revision would document the leasing program adopted for the SJNF and TRFO for the next 15 years.

The oil and gas leasing analysis applies to a total of 2.37 million acres of federal mineral estate within a 3-million-acre analysis area, of which 1.65 million acres (outside wilderness and withdrawn areas) have the potential for the occurrence of oil and gas resources (see Volume III, Appendix V, Map 48). The 0.91 million acres of private mineral estate within the planning area are not included in this oil and gas leasing analysis because the federal government has no leasing authority over privately held minerals regardless of surface ownership. However, surface use guidelines have been developed, other than NSO that the BLM/USFS, to the extent possible, would utilize if and when the holder of private mineral estate proposes to occupy federal surface. Surface use must be negotiated with the

private mineral owner. Table 3.19.1 identifies the potential for occurrence of oil and gas resources by mineral estate.

Table 3.19.1: Potential for Occurrence of Oil and Gas Resources by Mineral Estate

Surface Ownership	Total	High	High CBM	Low	Moderate	None
BLM	500,317	250,878	5,255	1,301	199,295	43,588
SJNF	1,864,839	10,514	44,439	520,857	889,249	399,781
Other federal	7,672	427	146	2,608	3,845	646
Tribal	0	0	0	0	0	0
Private	191,974	34,957	7,066	980	148,899	71
State	26,630	7,803	0	0	18,826	0
Total	**2,591,432**	**304,579**	**56,906**	**525,746**	**1,260,114**	**444,086**

In total, 528,000 acres of public mineral estate (439,000 BLM and 89,500 USFS) are currently leased for oil and gas development, primarily in the NSJB and Paradox Basin portions of the planning area. There are 370,000 acres of lease nomination pending process on the SJNF and TRFO during preparation of the revised LRMPs. The new leasing decisions would apply to the processing of new leases.

Legal and Administrative Framework

Oil and gas resources on NFS and BLM-administered lands are managed under a large body of laws and regulations. A few, however, are specific to the mineral resource itself and provide direction on the disposition of federally owned oil and gas resources, as well as administration of surface activities associated with development of these resources. These include:

- **The Mineral Leasing Act of 1920:** This act authorizes the Secretary of the Interior to issue leases for the disposal of certain minerals (currently applies to coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The act applies to NFS lands reserved from the public domain, including lands received in exchange for timber or other public domain lands and lands with minerals reserved under special authority.
- **The Federal Land Policy and Management Act of 1976:** This reiterates that the 1970 Mining and Minerals Policy Act shall be implemented and directs that public lands be managed in a manner that recognizes the nation’s need for domestic sources of minerals and other resources.
- **The Federal Onshore Oil and Gas Leasing Reform Act of 1987:** This act expands the authority of the Secretary of Agriculture in the management of oil and gas resources on NFS lands. Without USFS approval, the BLM cannot issue leases for oil and gas on NFS lands over the objection of the USFS. The USFS also has the authority to regulate all surface-disturbing activities on NFS lands.
- **The Energy Policy Act of 2005:** This act encourages energy efficiency and conservation, promotes alternative and renewable energy sources, reduces dependence on foreign sources of energy, increases domestic production, modernizes the electrical grid, and encourages the expansion of nuclear energy. The BLM and USFS are responsible for making public lands available for orderly and efficient development of these resources under principles of multiple-use management.

Process for Mineral Leasing and Oil and Gas Exploration and Development

The ROD for the LRMP revisions and the USFS leasing availability analysis would make the following decisions related to mineral leasing:

- **For BLM Lands:** Lands open for leasing (BLM Handbook H1601-1), including conditions (stipulations) under which lands would be open for leasing. A plan-level decision to open the lands to leasing represents the BLM's determination, based on the information available at the time, that it is appropriate to allow development of the parcel consistent with the terms of the lease, laws, regulations, and orders, and subject to reasonable COAs. (Selected alternative would be approved in the LRMP ROD.)
- **For NFS Lands:** Lands administratively available for leasing (36 CFR 228.102(d)), including conditions (stipulations) under which lands would be available. (Selected alternative would be documented in a USFS leasing availability ROD. The Forest Supervisor would make the leasing availability decision.)

The USFS and BLM leasing availability decisions constitute Stage 1 of a three-stage decision-making process for oil and gas leasing, exploration, and development.

At this first stage of analysis—identification of lands available for lease—the timing and location of project-specific actions are unknown, and the relationship between cause (future actions) and effect (impact on resources) is not always known or quantifiable. Therefore, the analysis of impacts is based on projected development assumptions (see Volume III, Appendix F). If the lands made available for lease are leased, there will be another environmental review to approve the location of an exploratory well before the leaseholder can drill the well (stage two). After a lessee has an exploratory and confirmation well, the leaseholder can submit an APD (i.e., to develop the lease). Before field development is authorized, there will be further environmental analysis and the SJNF or TRFO may require a plan of development (stage three). During this third analysis stage, project-specific information (well and road locations) is available and can be used for analysis of impacts. As a result, the impact analysis at the third stage is more specific and refined.

All areas of the SJNF and TRFO public lands exclusive of areas currently withdrawn from leasing and those areas administratively unavailable for leasing are analyzed. These lands include:

- The portions of the SJNF currently available for leasing – approximately 1,337,100 acres.
- TRFO public lands including split-estate lands currently available for leasing – approximately 761,000 acres.

Thus the net acreage analyzed for leasing on both federal jurisdictions totals 2,096,856 acres. The RFD projections for future oil and gas development activity forecast activities within a broad area of 928,000 acres of lands classified as having high or moderate potential for oil and gas. Within that area, if leased, there may be approximately 7,000 acres of land disturbance as a result of oil and gas exploration and development. These lands generally coincide with lands that are already leased and undergoing some level of development, leased and currently undeveloped, or where industry has submitted expressions of interest to lease federal mineral estate.

Conducting the Leasing Analysis

The leasing analysis provides the basis for making the leasing decision. Following direction in 36 CFR 228 102 (c)(l) and BLM Handbook H1601-1, the analysis identifies:

- Lands open to development with standard lease terms (described in Section 6 of every lease);
- Lands open to development, but subject to constraints that require the use of supplementary lease stipulations when the standard lease terms are not sufficient to protect surface and subsurface resources;
- Lands closed to leasing, distinguishing between those areas closed through exercise of management direction by the USFS or BLM and those closed by law or regulation. Such lands are identified in the oil and gas leasing maps for the alternatives (Volume III, Appendix V, Maps 49 through 60);
- Mitigation measures in the form of lease stipulations related to the different emphases of the alternatives for oil and gas management.

Based on their goals and resulting management emphases, LRMP Alternatives A and D emphasize more access for leasing and development with less restrictions. Alternatives B and C have more restrictions. The No Leasing Alternative represents no leasing of federal oil and gas on currently unleased lands and on leased lands when the current lease expires. After analyzing the effects of development on surface resources, including consideration of environmentally sound drilling technology, reclamation, and effects of prohibiting surface occupancy, the USFS or BLM may determine that the impacts are unacceptable for some areas. These areas may be made administratively not available for leasing at the discretion of the USFS or BLM.

The analysis also:

- Identifies land management alternatives that result in a range of possible leasing decisions (36 CFR 228.102 (c)(2) and BLM Handbook H1624-1);
- Includes a projection of the type and amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative (36 CFR 228.102 (c)(3) and BLM Handbook H1624-1); and
- Analyzes the reasonable foreseeable impact of post-leasing activity projected for the proposal and for each alternative (36 CFR 228.102 (c)(3) and BLM Handbook H1624-1).

These three requirements are addressed below.

3.19.2 Affected Environment

Existing Conditions and Trends

The existing condition is a result of the prior discovery and development of oil and gas resources. In addition to these known and developed resources, the existing condition includes estimates of the potential for the occurrence of undiscovered oil and gas resources, and the likelihood of their development during the 15-year planning period. This oil and gas leasing analysis is divided into the following major topics:

- Oil and gas occurrence potential in the planning area;
- Major oil and gas plays;
- The scenario for future oil and gas exploration and development activity;
- Trends in recent development and exploration activity; and
- The RFD scenario.

Each topic section provides a summary of the relevant data.

Oil and Gas Occurrence Potential

The RFD scenario projects oil and gas development for the planning area. The scenario is based on an assessment of the potential for the occurrence of oil and gas, and an estimate of the level and type of development activity that might occur should the affected lands be leased. This section of the analysis describes regions of different potential for accumulations of oil and gas in the planning area. The estimate of development activity is described in a following section.

A region of defined oil and gas resource potential may include adjacent non-SJNF or TRFO lands where the geology and exploration and development activity are important to describing potential for oil and gas resources in the planning area. The potential for occurrence of oil and gas in the planning area is based on the geology and major plays. Table 3.19.1 summarizes the potential for the occurrence of oil and gas (see Volume III, Appendix V, Map 48). As defined here, a play is a set of oil or gas accumulations that are geologically, geographically, and temporally related and that exist by virtue of identical or similar geological conditions. The oil or gas accumulations may be known to exist or be completely hypothetical and may be discovered or undiscovered. Geological characteristics such as reservoir lithology, timing and migration, trapping mechanisms, and source rock, as well as maturation, are taken into consideration in the definition and evaluation of each play. Estimates of undiscovered oil and gas resources in the planning area are derived from the 1995 and 2000 USGS national assessments of undiscovered oil and gas resources (USGS 2013).

The criteria used for designation of potential are from BLM Handbook H-1624-1, revised December 19, 1994:

- **High Potential:** The play demonstrates existence of source rock, thermal maturation, reservoir strata possessing permeability and porosity, and traps. Demonstrated existence is defined by physical evidence or documentation in the literature.
- **Medium Potential:** The play has geophysical or geological indications that the following may be present: source rock, thermal maturation, reservoir strata possessing permeability and porosity, and traps. Geologic indication is defined by geological inference based on indirect evidence.
- **Low Potential:** The play has specific geophysical or geological indications that one or more of the following may not be present: source rock, thermal maturation, reservoir strata possessing permeability and porosity, and/or traps.
- **No Potential:** The play has no currently recognizable potential. The play has demonstrated absence of source rock, thermal maturation, reservoir rock, and traps. Demonstrated absence is defined by physical evidence or documentation in the literature.

The following discussion provides information from which the oil and gas occurrence potential summary is derived, broken down by specific oil and gas province and play. Within each play, there may be several different estimates of potential for individual rock formations.

<u>San Juan Basin Province</u>

High Potential: Lands with high potential in Cretaceous rocks are present in the planning area in the extreme northern part of the San Juan Basin Province based on the presence of subsurface cretaceous rocks. Productive oil and gas fields such as the Ignacio-Blanco and Fruitland–Picture Cliffs, and production from the Dakota, “tight” Dakota, and Mesa Verde plays are in and/or immediately adjacent to the planning area. The oil and gas potential of fractured Mancos Shale is

considered to be high, particularly in the sandier and more dolomitic El Vado member. The potential for future oil and gas discoveries and development is high where the Dakota and younger rocks are present.

Medium Potential: Within the NSJB area, lands that are characterized by Cretaceous-, Jurassic-, Triassic-, and Permian-age sedimentary rocks at or near the surface are considered to have medium potential. This is particularly true in the vicinity of the southwestern flank of the Archuleta Anticlinorium on the northeastern flank of the San Juan Basin Province. Medium potential is also assigned to the Pennsylvanian rocks in the San Juan Basin Province part of the planning area.

Low Potential: Low potential is assigned to areas of the San Juan Basin Province where Mississippian and Devonian sedimentary rocks occur at or near the surface, although escalating oil prices may drive exploration interest higher with time.

No Currently Recognizable Potential: Lands that are characterized by pre-Devonian sedimentary rocks or igneous and metamorphic surface outcrops do not have any currently recognizable potential, although escalating oil prices may drive exploration interest higher with time.

<u>San Juan Sag Area</u>

High Potential: Cretaceous rocks in the southern and southwestern part of the San Juan Sag generally dip northeasterly away from the Archuleta Anticlinorium that separates the San Juan Sag from the San Juan Basin. The primary reservoirs are the Dakota and possible fractured shale of the Mancos. The Mesa Verde is also a potential objective in the northeastern part of the planning area in the San Juan Sag area. The Dakota and fractured Mancos Shale potential is considered to be high in this part of the planning area where Cretaceous outcrops and subcrops are not covered by tertiary volcanic rocks.

Medium Potential: The Entrada Sandstone has medium potential in the San Juan Sag part of the planning area. This is particularly true along the northeastern flank of the Archuleta Anticlinorium.

Low Potential: Very little is known about the Pennsylvanian section in the San Juan Sag area. However, it has been mentioned by several operators as a possible objective, if present, beneath the Mesozoic rocks in the sag. It is therefore given a low potential.

No Current Recognizable Potential: Mississippian and/or Devonian and older Paleozoic rocks are virtually unexplored and no recognizable potential is given to this stratigraphic package.

<u>Paradox Basin Province</u>

High Potential: In the northwestern portion of the planning area, actively producing fields in the Andy's Mesa, Cache, Cocklebur Draw, Flodine Park, Hamilton Creek, Hamm Canyon, Island Butte, McClean, Papoose Canyon, Roadrunner, Sleeping Ute, and Towaoc fields have high potential for continued expansion of production of gas and some oil in the Paleozoic section of the Paradox Basin Province of the planning area. The Carbonate Buildup Play and Structural and Fractured Shale Play both have high potential for oil and associated gas development in this proven area.

Medium Potential: The remaining portions of the Paradox Basin Province characterized by a stratigraphic sequence consisting of Cretaceous rocks at or near the surface and underlain by older Mesozoic and Paleozoic strata at depth exhibit moderate potential for the occurrence of oil and/or gas. Although the Mississippian section is still lightly explored, carbonates in the northwestern part of

the planning area are still considered prospective by industry and the distribution of hydrocarbons would probably be structurally controlled. They are assigned a medium resource potential

Low Potential: Generally, this includes the lands east of those areas with moderate hydrocarbon occurrence potential in the Paradox Basin Province. The low potential region is characterized by surface and near-surface Jurassic and older sedimentary rocks with a sedimentary section at least 1,000 feet thick.

No Currently Recognizable Potential: This area includes lands located east of the approximate limit of the Paradox Basin Province in the San Juan Dome Uplift Province of southwest Colorado. Igneous and metamorphic rock dominate the San Juan Dome Uplift with only a thin (<1,000 feet) total stratigraphic section where sedimentary rocks are present. It should also be mentioned that occasional, isolated plutonic rocks related to the uplift that extend into the Paradox Basin Province currently have no recognizable hydrocarbon occurrence potential.

See Volume III, Appendix V, Map 48 for the major tectonic provinces in the planning area.

Major Oil and Gas Plays

The northwestern portion of the planning area contains a number of important and productive oil and gas plays, many of which have been extensively explored since the last assessment of the region in the early 1990s. Since 1999, an average of 34 new wells has been added annually, equally split between CBM production and conventional oil and gas. In 2004, 331,000 barrels of oil and 89 billion cubic feet (BCF) of gas were produced in the planning area, excluding CO_2 production. CO_2 production from three wells in Montezuma County added another 321 BCF to the total gas produced in the area.

New potential plays in the planning area that have been upgraded in their resource potential in this analysis include the Entrada Play of the NSJB Province, the Structural and Fractured Shale Play and Mississippian Play in the southeastern Paradox Basin Province, and the GSGP in the central part of the eastern Paradox Basin Province of southwest Colorado. The SJNF and TRFO include parts of two major oil and gas provinces, the San Juan Basin Province (Province 022 of the USGS National Assessment) in the east and the Paradox Basin Province (021) in the west. The planning area also includes the southwestern part of the lightly explored, but oil productive, San Juan Sag. The San Juan Basin, which includes lands within northwest New Mexico and southwest Colorado, is the second largest natural gas field in the United States. CBM development in the San Juan Basin Province accelerated during the late 1980s and is currently the primary focus of natural gas development in the region. The Paradox Basin Province (Table 3.19.2 and Table 3.19.3) is an important oil and gas-producing region, and gas production, in particular, has accelerated in the last decade.

Table 3.19.2: Major Oil and Gas Fields in the San Juan Basin and San Juan Sag Provinces

Name	Type	Producing Reservoirs
Ignacio - Blanco	CBM/Gas	Mesa Verde Group (Point Lookout), Dakota, Fruitland Coal
Chromo	Oil	Fractured Mancos (limited production)
Menefee Mountain	Oil	Dakota; tests in Desert Creek, Ismay (limited production)
Gramps	Oil	Dakota and fractured Mancos (currently abandoned)
Navajo	Oil	Mesa Verde Group, Mancos, Gallup

Because the USGS National Assessment does not provide specific data for the plays in the planning area, the resource quantities given below are for the entire San Juan and Paradox Basin Provinces rather than for those portions within the planning area. An attempt to proportionate or delineate the specific resources of the planning area is presented where appropriate and possible.

Table 3.19.3: Major Oil and Gas Fields in the Paradox Basin Province

Name	Type	Producing Reservoirs
Andy's Mesa	Gas/Oil	Cutler, Cutler Arkose, Honaker Trail, Ismay
Cache	Oil	Ismay
Cahone	Oil/Gas	Honaker Trail
Cocklebur Draw	Gas	Hermosa, Paradox
Double Eagle	Gas	Honaker Trail, Cutler
Flodine Park	Oil/Gas	Ismay
Hamilton Creek	Gas/Oil	Hermosa, Cutler, Honaker Trail
Hamm Canyon	Gas	Hermosa
Island Butte	Oil	Desert Creek
Lisbon Southeast	Gas/Oil	Leadville
McClean	Oil/Gas	Desert Creek
Papoose Canyon	Oil/Gas	Desert Creek, Ismay
Roadrunner	Oil/Gas	Ismay
SE Andy's Mesa	Gas/Oil	Cutler, Cutler Arkose, Honaker Trail, Ismay
Sleeping Ute	Oil/Gas	Ismay
Stone Pony	Gas/Oil	Ismay
Towaoc	Oil/Gas	Ismay

According to the 2000 USGS National Assessment, the most likely estimates of undiscovered oil and gas resources in the San Juan Basin Province are 19 million barrels of oil (MMBO) and 50 trillion cubic feet (TCF) of gas. Much of the favorable area would be gas prone because of burial depths, source rock type, proximity to intrusive rock heat sources, or various combinations of these. Undiscovered oil resources in the Paradox Basin are larger, estimated at 500 MMBO. Gas is estimated at 1.5 TCF, although the inclusion of shale gas resources could significantly increase this estimate. Most of these resources in the Paradox Basin are likely to be distributed in small to moderate-sized accumulations rather than concentrated in a few large ones.

The CBM area in the San Juan Basin Province likely contains the vast majority of the undiscovered gas resource. Porous carbonate plays in the Paradox Basin Province would likely account for additional undiscovered oil. Substantial new gas reserves are also anticipated from Paleozoic plays in the eastern Paradox Basin Province, particularly from the emerging Pennsylvanian GSGP along the western border of the study area. While Mississippian and Devonian rocks on the western side of the planning area both probably have some potential, the volume of this resource is uncertain due to the presence and percentage of CO_2 and water in the natural gas and the likelihood of increased CO_2 percentages in the vicinity of the Laramide-age and younger intrusives. Lastly, the potential for undiscovered CO_2 as opposed to natural gas in the eastern Paradox Basin is highly uncertain.

San Juan Basin Oil and Gas Plays

Conventional oil and gas exploration and development in the San Juan Basin is largely found in the Ignacio-Blanco field, which produces from the Dakota Sandstone, Fruitland Formation, Pictured Cliffs Sandstone, and the Mesa Verde Group. The field was discovered in 1950. The Dakota Sandstone, Mesa Verde Group, and Pictured Cliffs Sandstone are the principal producing horizons and typically

yield dry gas with small quantities of produced water and associated hydrocarbon liquids. By 1995, the Dakota Sandstone had produced 279 BCF of gas. Production from the Dakota Sandstone reached its peak in 1996, but this formation may still have potential for limited development. The Mesa Verde Group produced 678 BCF of gas and 40,000 barrels of condensate from 1952 to 1995. Wells completed in the Pictured Cliffs Sandstone, which includes the Pictured Cliffs Sandstone and Fruitland sand, produced 88 BCF through 1995. Current production is limited to small amounts of oil. As of December 2001, 13 active conventional gas wells existed in the Ignacio-Blanco field.

The majority of the gas produced from the planning area, excluding CO_2 production from McElmo Dome in Montezuma County, comes from the Ignacio-Blanco CBM field.

Paradox Basin Province

Most of the production in the province has been from porous carbonate buildups, mainly algal mounds (porous-carbonate buildup play, USGS Code 2102), around the southwestern shelf margin of the Paradox evaporite basin. The giant Aneth field, with more than 1 billion barrels of oil in place, accounts for about two-thirds of the proven resources in the province, and other fields such as the Ismay in this primarily stratigraphic play account for much of the rest. Most of the other plays have a strong structural component, particularly the Buried Fault Blocks, Older Paleozoic (USGS Code 2101), Fractured Interbed (2103), and Salt Anticline Flank (2105) Plays. The Permian-Pennsylvanian Marginal Clastics Play (2104) is a combination of both structure and stratigraphy. The Fractured Interbed Play (2103) is an unconventional, continuous play.

The westernmost part of the planning area lies within the southeastern part of the Paradox Basin Province. The Paradox Basin was formed in Middle Pennsylvanian time as a result of faulting along the pre-existing, northwest-trending Uncompahgre lineament, with uplift to the northeast and corresponding basin down-warping across the faults to the southwest. Salt anticlines developed in the deeper part of the basin, which has the thickest section of evaporates, as salt moved upward in response to sediment-loading from the north. The basin contains the thickest sediments along the northeastern margin, where it is bounded by the Uncompahgre uplift.

Summary of Plays in Paradox Basin Province

The primary oil and gas–producing formation is the Middle Pennsylvanian Paradox Formation, which consists of cyclic carbonates, clastics, and evaporates deposited in a marine environment (Scott 2003). The oldest formation with oil and gas production is the upper Mississippian Leadville Limestone. Overlying Pennsylvanian rocks include the Molas Formation and the Hermosa Group, which includes the Paradox and Honaker Trail formations. The Paradox Formation includes most of the evaporites, and the majority of the production is from the interbedded carbonates. Prodetta clays of the Gothic Shale and Hovenweep Shale Members of the Paradox Formation may contribute to production in the basin in the near future. The overlying Honaker Trail consists of marine carbonates, shales, siltstones, and sandstones. The Permian Cutler Formation consists of fluvial sandstones and shales. The Cutler Formation is the youngest interval of potential gas production within the planning area.

The USGS 1995 National Oil and Gas Assessment project (USGS 2013) identified five major plays in the Paradox Basin Province that overlap with parts of the planning area:

- Buried fault blocks, older Paleozoic (2101) – northwestern corner of planning area;
- Salt anticline flanks (2105) – follows same boundary as Buried Fault Blocks Play;
- Fractured interbeds (2103) – follows same boundary as Buried Fault Blocks Play;

- Porous carbonate buildup (2102) – west of Lizard Head wilderness; and
- Permian-Pennsylvanian Marginal Clastics (2104) – northwest part of the planning area adjacent to and east of the Paradox Basin boundary.

Scenario for Future Oil and Gas Exploration and Development Activity

Projecting expected oil and gas activity is necessary to assess potential effects of leasing the SJNF and TRFO for oil and gas exploration and development. This part of the analysis presents the type and level of potential activity principally based on geology and past and present activity. Economics and technology, access to an area of interest, and the availability of processing facilities and transportation also play a role in exploration and development activity levels. Some of these factors, such as economics and technology, are difficult to predict due to their complexity, interactive nature, and variability in time. This analysis is based on what is currently known about geology and industry activity and does not attempt projections of future fluctuations in oil and gas markets and political factors or rapid and unpredictable changes in technology or discoveries that may trigger new plays in the area.

Projected oil and gas activity may not always equate with geologic potential for the existence of hydrocarbons. In some areas where all the geologic factors indicate a high potential for oil and gas resources, other factors, such as inaccessibility, risk, high exploration costs, and low oil and gas prices, may limit the potential for exploration and development activity. Consequently, an area of high potential for hydrocarbon occurrence may have a low potential for exploration and development activities. Conversely, such factors as rapidly escalating product prices or advances in technology could lead to drilling activity in areas considered to have a low potential for oil and gas occurrence. In any case, current projections of activity are based on currently known conditions and reasonable expected changes in technology and price factors.

Based on an analysis of the geology and plays in the planning area and their resource potential, the parts of the planning area that have high and moderate potential for oil and gas occurrence and development are:

- The clastic terrane in the San Juan Basin Province, largely from source and reservoir rocks (including coals) in the Cretaceous section;
- The Cretaceous and Jurassic section in the San Juan Sag;
- The carbonate terrane in the Paradox Basin Province, largely from source and reservoir rocks in the Pennsylvanian, with lesser contributions from the Permian and Mississippian section; and
- The Pennsylvanian GSGP of the Paradox Basin Province, with highly speculative future potential in similar organic-rich shales (e.g., Hovenweep Shale) of the Paradox Formation.

The EIS for the NSJB-CBM project in La Plata and Archuleta Counties (BLM and USFS 2006a) analyzed a proposal by six companies to drill approximately 300 new CBM wells in the NSJB between 2007 and 2012. One hundred and thirty-eight wells are approved for drilling on federal lands; the remainder of the development would occur on private and state lands. The overall life of this CBM project, including construction, production, and reclamation, would be approximately 30 to 35 years.

<u>Infrastructure</u>

A critical issue is how gas moves into the San Juan Basin pipeline system through the Blanco Hub. Consideration is primarily given to trunk pipelines—large capacity lines used to transport gas or oil to market. Credible data are not available to address local gathering infrastructure. Currently, the

Paradox, Piceance, and Uinta Basins all flow south to the Blanco Hub. There is insufficient capacity in these pipelines to accommodate the future development projected in the RFD scenario through 2020. For example, the Trans-Colorado Pipeline (Table 3.19.4), a major conduit for gas from the Paradox Basin, is at or near capacity. As more gathering capacity is built to feed the Blanco system, capacity constraints are likely for transmission out of the Blanco Hub. Currently, transmission capacity is very tight at the Blanco Hub, and if additional Paradox, Piceance, and Uinta gas flows into the system, transmission capacity constraints could emerge.

Table 3.19.4: Major Pipelines Crossing the San Jan National Forest and Tres Rios Field Office

Name	Use
Basin	Gas
Mid-America	Gas
Public Service of Colorado	Gas
Rocky Mountain	Gas
Trans-Colorado	Gas
Trans-Texas	CO_2
Northwest	Gas

It is projected that within the next 5 to 10 years a pipeline parallel to either the existing Trans-Colorado or the Northwest gas pipeline would be required. The parallel pipeline would be mostly located in an existing pipeline corridor ROW. In the interim, the capacity of the Trans-Colorado Pipeline may be increased with additional compression. In addition, some availability currently exists in Williams' Northwest interstate gas pipeline. Although power and road capacity are sufficient to handle near-term development in the RFD area, it is expected that additional transmission lines and new and/or upgraded transportation corridors would need to be established within the next 5 years should the GSGP become a viable development target in the Paradox Basin Province.

In the HD Mountains area, a critical part of the future development of CBM, the only pipeline that is available to transport gas is the Public Service of Colorado line, which is a high-pressure (900 pounds per square inch [psi]) consumer line. CBM from the HD Mountains area may contribute considerably more production than is currently estimated, particularly with the potential for 80-acre down-spacing.

Although the pipeline infrastructure in the planning area is basically in place, capacity for future gas development appears problematic. Current pipeline capacity constraints in the Paradox Basin Province could effectively diminish long-term activity levels in drilling and production in the emerging GSGP. In addition, the need to transport gas from future infill CBM wells of the NSJB Province may further restrict development activities in the planning area if new pipelines are not built to transport gas from the San Juan Basin to eastern markets. A 22-inch pipeline parallel to the existing 22-inch Trans-Colorado Pipeline could alleviate some of the pipeline capacity problems in the study area. In addition, Williams Midstream is considering construction of a large trunkline extending along the existing Northwest pipeline corridor from the eastern Paradox Basin and through the NSJB for processing at the Ignacio Gas Plant in southern Colorado. Such projects are critical infrastructure elements to the future successful development of oil and gas reserves in the planning area.

Impacts of Future Technology

A number of emerging and conventional exploration and development technologies are being used or evaluated in and adjacent to the planning area. These include utilization of directional and horizontal drilling methods, mulit-lateral drilling techniques, and multi-zone/multi-stage hydraulic frac

completions. Some of the more important practices relevant to the planning area are discussed below.

Conventional well drilling is still common in the planning area, where vertical wellbores are the preferred drilling and completion method for oil and gas wells. There is lower cost and risk by drilling vertically. Reserves often can be captured adequately with vertical wellbores. When pumping is required to produce the oil, maintenance costs are lower in vertical wellbores. However, directional drilling techniques have been increasingly applied in the planning area. Horizontal and stimulation technologies are also being utilized more frequently in the area, and these techniques are likely to continue to be used at an increasing rate.

Directional and Horizontal Drilling

Directional (purposely deviated) drilling allows operators to target one or more subsurface targets in positions that are laterally offset to the surface location of a given wellbore. Horizontal wells are a subset of directional wells that are initially drilled into the ground surface vertically and then turned to ultimately become horizontal with the earth's surface near the bottom of the borehole. The ability to directionally orient a wellbore enables multiple wells to be drilled from an individual well pad location, thereby confining construction, drilling, and completion operations to the one "multi-well pad" site. Although multi-well pads are somewhat larger than their "single-well pad" counterparts, they typically have less overall surface disturbance as compared to the same number of wells that would have been vertically drilled from several single-well pads. Directional drilling techniques can be particularly helpful in environmentally sensitive or culturally rich areas where valuable surface resources can sometimes be even entirely avoided with slight changes in surface location and subsequent directional drilling to the desired subsurface target. In addition, directional and horizontal wellbores often lead to increased production efficiency because a longer segment of the target interval(s) is available to complete and flow hydrocarbons as compared to the equivalent section in a vertical borehole completion. Although directional drilling practices are rapidly becoming commonplace throughout the planning area, all these benefits are offset by the incremental increase in both well cost (approximately 20%t) and operational risk associated with drilling these more complex boreholes. In general, the more deviated a well, the higher the cost and the greater the trouble-time.

The application of directional drilling technology has only recently become suitable and economically viable in the planning area. In the NSJB, infill CBM wells are now routinely being directionally and horizontally drilled from existing surface locations in an effort to reduce surface disturbance in this intensely developed resource area. The next advancement in horizontal well technology currently emerging in the NSJB is drilling multi-laterals and/or hydraulic fracturing of horizontal wells. Multilaterals could be one, two, or several branched lateral wellbores within a single formation or single laterals in two or more formations.

The drilling of deviated boreholes in the eastern Paradox Basin is even a more recent occurrence than that observed in the San Juan Basin Province. Directional wells have been drilled in the northwestern part of the planning area. The fields in this area are highly compartmentalized and structurally complex, and the ability to stack multiple, offset targets within a single borehole adds incremental reserves to these deviated wellbores. In some cases, existing vertical wells are being re-entered, and directional or horizontal penetrations are being sidetracked out of the original holes in order to accelerate production in proven reservoirs and/or add new, undeveloped reserves from zones that were sub-commercial in lower rate, vertically drilled wellbores. Horizontal drilling in the planning area is just now being introduced with the discovery of GSGP reserves near the western boundary of the planning area. If sustained, economic production rates can be attained in these newly drilled boreholes, then it is anticipated that all future GSGP development wells would be horizontal

penetrations. In addition, the average length of the lateral sections is expected to increase as well costs and operational risks are more efficiently managed by the operators over time.

Reasonable Foreseeable Development

Historical development and price trends, USGS and Energy Policy and Conservation Act resource estimates, current drilling and development activity, existing leases, pending wells, pending leases, and pipeline and power infrastructure were considered in formulating this analysis. The projection of drilling activity, both exploratory and development, is based primarily on the long-term, gradual escalation of oil and gas prices that corresponds closely to the historical drilling activity and would mostly be confined to the high and moderate potential areas (see Volume III, Appendix V, Map 48). Approximately 2,900 new wells may be drilled on all jurisdictions in the planning area during the 15-year period (Table 3.19.5).

The estimates of land disturbance resulting from drilling and production contain estimates of timing (when the disturbance would occur within the 15-year planning period) and estimated disturbance within the provinces. Without site-specific proposals for well site locations, it is not possible to identify exactly where the estimated disturbance would occur. However, it is reasonable to assume that most disturbance would occur at intervals throughout the planning period rather than all at once and/or that the majority of the estimated disturbance would be within or adjacent to existing fields (with the exception of the GSGP) and mostly along existing primary road and pipeline corridors. Estimates of exploratory wells that are dry holes (occupied for 1–2 years) verses production wells (which may be occupied for 20–40 years) are provided.

It is important to note that these projections do not consider the various environmental and land management constraints (such as special lease stipulations and MA direction) that may be imposed by the Preferred Alternative and other alternatives analyzed in this FEIS. Approximately 50% of development is projected to occur on existing leases and hence is not subject to the leasing decisions in the LRMP.

<u>Reasonably Foreseeable Development Projections</u>

Based on the resource occurrence potential discussed in the previous section, industry interviews and leasing trends, and the price and development trends identified above, the following RFD projections are made. These are totals within the planning area including projected development on currently leased and unleased lands, and for all jurisdictions (Table 3.19.5).

Table 3.19.5: Reasonably Foreseeable Development Scenario for the Planning Area and Number of Wells on All Jurisdictions

Land Ownership	Paradox Basin	GSGP	NSJB (remainder of 160-acre spacing units)	NSJB (80-acre spacing units)	San Juan Sag
BLM public lands (including federal split estate	185	425	27	57	0
NFS lands	140	585	111	143	30
State lands (surface and mineral estate)	0	0	7	7	0
Private lands (surface and mineral estate)	50	760	92	283	0

Land Ownership	Paradox Basin	GSGP	NSJB (remainder of 160-acre spacing units)	NSJB (80-acre spacing units)	San Juan Sag
Total	**375**	**1,770**	**237**	**490**	**30**

Paradox Basin: The Paradox Basin is split into two distinctive plays referred to as the Paradox Basin conventional and GSGP:

- The Paradox Basin Province conventional gas play in the RFD area would grow at an average of 25 wells per year for a period of 15 years (all jurisdictions). This total includes an assumed average development of 10 wells per year (150 wells total) in the Dolores lease nomination area (SJNF) and 15 wells per year (approximately 185 wells total) on BLM public lands in the Paradox Basin RFD area. Total production during the next 15 years in the Paradox Basin Province of the RFD area is projected to be 8.7 MMBO and 740 BCF of conventional gas. There is an approximate 80% success rate for wells drilled in the BLM portion of the Paradox Basin. For the purpose of projecting development on NFS lands, the same 80% success rate is assumed.
- Within the GSGP, development of approximately 1,770 wells is projected over the next 15 years. Of that total, 1,010 wells are projected on federal mineral estate and 760 wells are projected on private mineral estate.

NSJB: The following is likely to occur in the NSJB:

- CBM development in the San Juan Basin Province of the RFD area would grow at an average of 40 wells per year for a period of approximately 6 years at current spacing (all jurisdictions). This total of 237 CBM wells is taken from the Industry Proposed Action analyzed in the NSJB FEIS (USFS and BLM 2007).
- In addition, the Fruitland Formation CBM wells could grow at an additional rate of 80 wells per year over a 6-year period or a total of 490 wells north of the Ute Line if 80-acre spacing is approved (all jurisdictions). All wells drilled are projected to be production wells. This would result in an average annual production increase of 16 BCF of CBM and a total increase in annual production to 240 BCF by 2023. The projected total production of CBM over the next 15 years in the San Juan Basin Province of the RFD area is 4.58 TCF.
- Additional exploration for conventional oil and gas in the San Juan Basin Province in the RFD area would result in an average of two exploratory wells per year over the next 15 years (all jurisdictions). Exploration would occur in the Fractured Mancos, Dakota, and Mesa Verde Plays.

The San Juan Sag would see exploration activity at an average of two wells per year on NFS lands.

In summary, considering all areas and jurisdictions, this RFD scenario projects approximately 190 wells per year throughout the RFD area on all jurisdictions for the first 5 years and approximately 195 wells per year for the subsequent 10 years, for a total of 2,900 new wells on 2,400 pads (see Table 3.19.5).

Well Disturbance

Table 3.19.6 through Table 3.19.10 describe projected gas development and corresponding land disturbance associated with the above RFD scenario on NFS lands, BLM public lands, and federal subsurface within the area where development is predicted. Also presented is the rate of development on the public lands for the first 5-year and subsequent 10-year development projection.

Unconstrained development is projected to be greatest in the GSGP within the Paradox Basin Province followed by 80-acre infill development of CBM wells in the NSJB.

- Assumptions for Paradox Basin conventional gas surface (pads, roads, water ponds) disturbance:
  - Average pad disturbance per well = 1.6 acres (average accounts for post-drilling interim reclamation and accommodates all on-lease facilities).
  - Average road disturbance per well = 2.4 acres.
  - Total surface disturbance per well = 4 acres.
  - Approximately 15-percent of wells are assumed non-productive and reclaimed.
- Assumptions for Paradox Basin GSGP surface (pads, roads, reserve pits, freshwater storage ponds, and construction impacts) disturbance:
  - Average pad disturbance per single well = 4.5 acres.
  - Average pad disturbance per two wells on a single pad = 5.5 acres
  - Average road disturbance per well = 2.4 acres.
  - Total surface disturbance per single well on a single pad = 6.9 acres.
  - Total surface disturbance per two wells/pad = 7.9 acres.
  - Associated flowlines would be collocated in access road ROWs = 0 acres of surface disturbance.
  - Approximately 12% of wells are assumed non-productive and reclaimed.
- Surface Disturbance Assumptions for Additional Infrastructure:
  - One major gas transmission pipeline may be needed as the GSGP develops and is assumed to be located on private surface land.
  - Gathering pipelines, compressor stations, and gas processing plants may be needed and are assumed to be located on public (60%) and private surface (40%) land and parallel to an existing pipeline corridor in the area.
  - Access road ROWs assume collocated associated flowlines. Thus, associated disturbance from flowlines is included in the access road disturbance calculations.
  - Downhole well spacing for the GSGP area is assumed to be 160 acres (i.e., 4 wells per square mile). Pad spacing is assumed to be 320 acres (i.e., 2 pads per square mile).
- Water Consumption Assumptions:
  - Water consumption for a conventional well in the PLAA would equal 32,000 barrels (1,000,000 gallons)—plus or minus 25%, meaning that the exact amount is a function of well depth.
  - A typical GSGP well would use 100,000 barrels (4,200,000 gallons) of water to drill, fracture, and complete the well. No water would be obtained from public lands. All water would be purchased by the gas companies from private sources. There would be a 40% water recycle rate, meaning that 60,000 barrels would be required on average per well after the first well is supplied.
- Disposal of Wastewater and Fracking Material Assumptions:

- No evaporative pits would be authorized on public lands.
- At a minimum, wastewater would be disposed of according to EPA and CDPHE standards.

Table 3.19.6: Unconstrained (baseline) Projection of Wells and Well Access Road Miles, and Corresponding Disturbance Acres on National Forest System Lands in the Northern San Juan Basin, San Juan Sag, and Paradox Basin, 2013–2027

Existing and Projected Wells – NFS Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	32	0	0	255	0	0
NSJB – Conventional	0	0	30	0	0	0
San Juan Sag	0	0	5	0	25	0
Paradox Basin – Conventional	0	0	2	6	16	96
Paradox Basin – GSGP	0	0	12	81	63	427
Total	32	0	49	342	104	523
Existing and Projected Roads* – NFS Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	16	0	0	70	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	2	0	12	0
Paradox Basin - Conventional	0	0	1	3	8	47
Paradox Basin – GSGP	0	0	4	30	23	153
Total	16	0	7	103	43	200
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	110	0	0	585	0	0
NSJB – Conventional	0	0	15	0	0	0
San Juan Sag	0	0	20	0	100	0
Paradox Basin - Conventional	0	0	10	25	65	385
Paradox Basin – GSGP	0	0	60	435	340	2,270
Total	110	0	105	1045	505	2,655

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.7: Unconstrained (baseline) Projection of Yearly Averages of Wells and Access Road miles, and Corresponding Acres Disturbed on National Forest System Lands

Development Area	Average Number of Wells, Road Miles,* and Corresponding Disturbance Acres Projected to be Drilled per Year on NFS Lands (2013–2017)	Average Number of Wells, Road Miles,* and Corresponding Disturbance Acres Projected to be Drilled per Year on NFS Lands (2018–2027)
NSJB – CBM	13 wells, 7 miles, 52 acres disturbed	14 wells, 0 miles, 7 acres disturbed
NSJB – Conventional	2 wells, 0 miles, 2 acres disturbed	2 wells, 0 miles, 2 acres disturbed
San Juan Sag	2 wells, 1 miles, 8 acres disturbed	2 wells, 1 miles, 8 acres disturbed
Paradox Basin	5 wells, 3 miles, 25 acres disturbed	10 wells, 5 miles, 40 acres disturbed
GSGP	4 wells, 2 miles, 22 acres disturbed	35 wells, 18 miles, 190 acres disturbed
Total	26 wells, 13 miles, 109 acres disturbed	63 wells, 24 miles, 247 acres disturbed

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.8: Unconstrained (baseline) Projection of Wells and Well Access Road Miles, and Corresponding Disturbance Acres on Bureau of Land Management–Administered Lands, including Split Estate Federal Minerals, in the Northern San Juan Basin, San Juan Sag, and Paradox Basin, 2013–2027

Existing and Projected Wells – BLM Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	30	0	0	84	0	0
NSJB – Conventional	0	0	10	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin - Conventional	90	20	15	88	15	87
Paradox Basin – GSGP	0	0	32	216	23	153
Total	120	20	57	388	38	240
Existing and Projected Roads* – BLM Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	20	0	0	14	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	45	10	7	43	7	44
Paradox Basin – GSGP	0	0	14	77	8	54
Total	65	10	21	134	15	98

Existing and Projected Disturbance Acres	Existing Wells and Roads		Projected Disturbance Existing Leases		Projected Disturbance Future Leases	
	Total Acres Disturbed	Total Acres Projected to be Reclaimed	Non-productive Wells and Associated Roads (reclaimed)	Total Acres Disturbed – Production Wells and Roads	Non-productive wells and Associated Roads (reclaimed)	Total Acres Disturbed – Production Wells and Roads
NSJB – CBM	75	0	0	165	0	0
NSJB – Conventional	0	0	5	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	360	80	60	350	60	375
Paradox Basin – GSGP	0	0	205	1,165	120	795
Total	435	80	270	1,680	180	1170

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.9: Unconstrained (baseline) Projection of Yearly Averages of Wells and Access Road miles, and Corresponding Acres Disturbed on BLM-administered Lands

Development Area	Average Number of Wells, Road Miles,* and Corresponding Disturbance Acres Projected to be Drilled per Year on BLM lands (2013–2017)	Average Number of Wells, Road Miles,* and Corresponding Disturbance Acres Projected to be Drilled per Year on BLM lands (2018–2027)
NSJB – CBM	14 wells, 3 miles, 25 acres disturbed	0 wells, 0 miles, 0 acres disturbed
NSJB – Conventional	1 well, 0 miles, 0 acres disturbed	1 well, 0 miles, 0 acres disturbed
San Juan Sag	0 wells, 0 miles, 0 acres disturbed	0 wells, 0 miles, 0 acres disturbed
Paradox Basin	12 wells, 6 miles, 50 acres disturbed	12 wells, 6 miles, 50 acres disturbed
Gothic Shale	3 wells, 2 miles, 15 acres disturbed	25 wells, 13 miles, 135 acres disturbed
Total	30 wells, 11 miles, 90 acres disturbed	38 wells, 19 miles, 185 acres disturbed

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.10: Total Land Disturbance (acres) Projected from Pipelines and Compressors

Development Area	Pipelines Outside Road ROWs Including Trunk Lines	Projected Compressors
NSJB – CBM	0	0
NSJB – Conventional	0	0
San Juan Sag	0	0
Paradox Basin – Conventional	0	0
GSGP	0	32
Total	0	32

Non-discretionary versus Discretionary Development

Non-discretionary development for the purpose of this environmental analysis is defined as development that may take place on currently leased lands over the next 15 years (Table 3.19.6 and Table 3.19.8). The right to develop the leases represents an agreement to allow development that is

conveyed to the lessee by the federal government. Development of existing leases may proceed if the proposed operations meet the requirements of applicable federal laws (e.g. the ESA and others). Many of the existing leases in the planning area are held by production, meaning that current energy development on the leases holds the leases active until production ceases. Consequently, these lands would not be available for re-leasing until current production ceases and the leases expire. Approximately half of the projected development would occur on existing leases and is considered non-discretionary from the standpoint of this leasing analysis. The areas where projected development would occur on existing federal leases are the NSJB (340 federal wells), portions of the Paradox Basin (180 new federal wells), and portions of the GSGP (375 wells).

Development of existing leases would be conditioned to the extent that their development and operations are to be consistent with the management requirements of the revised plans and within the authority reserved by the terms and conditions of the lease.

For example, surface use and timing restrictions stipulations resulting from the LRMP cannot be retroactively applied to existing leases. However, based on site- or project-specific environmental analysis, COAs implementing LRMP standards and guidelines could be applied at the development stage (individual wells or master development plans) to mitigate potential impacts from oil and gas operations within existing lease areas, providing the leaseholder’s right to develop the lease remains intact. The lease stipulations have comparable standards and guidelines in the LRMP.

The potential oil and gas development of existing leases would be consistent with LRMP direction and the terms and conditions of the lease. Impacts from future development on lands currently held under lease are generally subject to the terms and conditions under which they were originally leased. However, the BLM has the discretion to modify surface operations or add specific mitigation measures to the lease terms at the project level when supported by scientific analysis and when necessary to comply with plan direction.

Discretionary development decisions for the purpose of this environmental analysis are defined as development projected to take place on currently unleased lands if leased (see Table 3.19.6 and Table 3.19.8). These lands are subject to leasing availability decisions that would be documented in the ROD for the LRMP revision. Areas of currently unleased lands, where the new leasing decisions would directly impact RFD, include the SJNF portion of the Paradox Basin (110 new conventional gas wells projected on currently unleased lands), the SJNF portion of the San Juan Sag (25 new wells projected on currently unleased lands), the BLM portion of the Paradox Basin (100 new conventional gas wells projected on currently unleased lands), and the BLM/SJNF portions of the GSGP (670 new wells projected). Thus, the projected level of discretionary development, determined by leasing decisions made in the LRMP revisions, totals approximately 900 new wells.

For the purpose of analysis, all wells and associated impacts projected in the RFD scenario are analyzed whether or not they represent discretionary or non-discretionary development. This total level of projected development is also analyzed in relation to current development and development on other land jurisdictions to evaluate the cumulative effects of oil and gas development within the planning area.

<u>Acres Available and Stipulated by Alternative</u>

Table 3.19.11 displays acres that are withdrawn to date and acres administratively not available for leasing as a result of the alternatives. The total acres tabulated include the entire federal mineral estate, whether or not the federal government owns the surface. The oil and gas alternative maps

(Volume III, Appendix V, Maps 49–60) provide a spatial depiction of the leasing categories and stipulations.

Table 3.19.11 tabulates oil and gas leasing availability for the combined NFS, BLM, and subsurface mineral estate by alternative, and the stipulations that apply to such lands.

Stipulations are not applied to areas that are withdrawn or administratively not available for lease. As indicated in Table 3.19.11, the acres withdrawn from leasing are constant across alternatives. The acres administratively not available for leasing vary by alternative; Alternative C contains the largest amount of not-available acres due to wilderness recommendations and making several other resources and areas not available, such as the Dolores River Canyon, occupied Gunnison sage-grouse habitat, federal minerals underlying state wildlife areas, municipal watersheds, existing and proposed NRHP districts, and WSR recommendations. Correspondingly, Alternative C also has the least acreage available for lease.

Table 3.19.11: Oil and Gas Leasing Availability by Alternative

Jurisdiction	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
USFS					
Federal mineral acres	1,863,402	1,863,402	1,863,402	1,863,402	1,863,402
Acres withdrawn from leasing	509,954	509,954	509,954	509,954	509,954
Acres administratively not available for leasing	16,357	73,636	644,113	14,896	1,353,448
Acres available for leasing	1,337,090	1,279,811	709,335	1,338,551	0
NSO	848,806	876,266	547,642	666,105	0
CSU	513,893	882,532	391,150	1,033,242	0
TL	783,302	527,489	157	45,463	0
Standard lease terms	177,162	143,722	129,069	210,570	0
BLM					
Federal mineral acres	503,466	503,466	503,466	503,466	503,466
Acres withdrawn from leasing	0	0	0	0	0
Acres administratively not available for leasing	62,437	62,570	161,637	56,916	503,466
Acres available for leasing	441,030	440,896	341,829	446,550	0
NSO	132,713	194,290	318,601	98,486	0
CSU	35,948	401,232	300,504	406,487	0
TL	343,440	321,435	64	28,679	0
Standard lease terms	48,344	22,734	16,729	35,570	0
Federal Subsurface					
Federal mineral acres	319,957	319,957	319,957	319,957	319,957
Acres withdrawn from leasing	0	0	0	0	0
Acres administratively not available for leasing	0	0	0	0	319,957
Acres available for leasing	319,957	319,957	319,957	319,957	0
NSO	36,041	88,548	197,478	34,565	0
CSU	23,705	214,839	171,786	214,665	0
TL	167,189	161,301	0	461	0
Standard lease terms	128,016	82,233	110,718	104,039	0

LRMP Alternatives A and D by their emphasis provide more area available for leasing and development with less restrictions or area recommended for wilderness as compared to Alternatives

B and C. Alternatives B and C, in contrast, include more restrictions that result in NSO stipulations because of their emphasis on maintaining most of the large, contiguous blocks of undeveloped lands with NSO stipulations or through wilderness recommendations that result in areas not available for leasing. IRAs administratively not available due to wilderness recommendation in Alternative C are not recommended for wilderness and are stipulated NSO in Alternatives B and D.

Acres stipulated with CSU and/or TLs are similar between alternatives, as a result of the stipulation's application to specific resource conditions such as highly erosive soils, steep, slopes, critical wildlife habitat, various game ranges, and other factors that are mostly physical or biological and do not vary by alternative.

Acres with standard lease terms are highest in Alternative A as a reflection of the leasing decisions in the current BLM and USFS land management plans.

The No Leasing Alternative by definition has no areas administratively available for leasing over the period of the revised LRMP.

3.19.3 Environmental Consequences

This analysis includes development projections for three development areas. The first, the Paradox Basin (which includes conventional development and the GSGP development area), focuses on the PLAA because it is the area with the highest leasing interest within the planning area, has high development potential as reflected in the RFD projections for the area (1,335 federal wells), and because much of the area is currently unleased (72%) and subject to lease after approval of the LRMP. On the basis of these factors, a focused analysis of this portion of the overall planning area is necessary to inform decision-making regarding whether, where, and how to lease lands with high potential for development over the next 10 to 15 years.

The NSJB also includes high development potential. However, unlike the PLAA, the NSJB is fully leased and developed. Within the NSJB, the remaining question is how to condition further development of existing leases as additional wells are proposed. Anticipated development would involve constructing infill wells on existing, expanded well pads. The analysis of NSJB development and the relation to the revised LRMP decisions is also analyzed in this chapter.

A third area with gas potential is the San Juan Sag. It is projected that one to two exploratory wells would be requested annually over the life of the LRMP and that there would be minor interest in leasing in the San Juan Sag. This level of activity does not warrant analysis of the focus that is applied to the PLAA and would not be documented in detail in this chapter.

The Leasing Alternatives

Alternative A

Alternative A represents the continuation of current BLM and USFS leasing direction (). This direction is contained in the BLM Colorado Oil and Gas Leasing and Development EIS (BLM 1991b), the San Juan/San Miguel Resource Management Plan (BLM 1985) and the San Juan National Forest Land and Resource Management Plan (USFS 1983), both as amended. In total, 1,719,484 acres are available for leasing in Alternative A, of which approximately 1,293,931 acres are stipulated with TL, 573,546 acres are stipulated with CSU, and 1,017,560 acres are stipulated with NSO.

Projected oil and gas development for the BLM and NFS lands under Alternative A (Table 3.19.12 and Table 3.19.13) includes approximately 590 well pads. Approximately 90 well locations are

projected to be non-productive and reclaimed after production testing. For the GSGP alone, 420 well pads would be constructed on future leases.

Wells potentially displaced by NSO stipulations may total approximately 40, and a total of 30 projected wells may be eliminated because they would be displaced to areas that are administratively not available for leasing.

Under Alternative A, approximately 2,850 acres would be cleared to accommodate projected well pads and access roads on future leases.

Maps 49, 53, and 57 in Volume III, Appendix V depict lands that are available for leasing, lands that are withdrawn from leasing, lands that are administratively not available for leasing, and the stipulations that apply to lands available for leasing under Alternative A.

Table 3.19.12: Alternative A: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on National Forest Service Lands, 2013–2027

Existing and Projected Wells – NFS Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	32	0	0	255	0	0
NSJB – Conventional	0	0	30	0	0	0
San Juan Sag	0	0	5	0	25	0
Paradox Basin – Conventional	0	0	2	6	14	96
Paradox Basin – GSGP	0	0	8	59	44	298
Total	32	0	45	320	83	394
Existing and Projected Roads* – NFS Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	16	0	0	70	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	2	0	12	0
Paradox Basin – Conventional	0	0	1	3	7	48
Paradox Basin – GSGP	0	0	4	36	22	150
Total	16	0	7	109	41	198
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	110	0	0	585	0	0
NSJB – Conventional	0	0	15	0	0	0
San Juan Sag	0	0	20	0	100	0
Paradox Basin – Conventional	0	0	10	25	55	385
Paradox Basin – GSGP	0	0	60	435	335	2265
Total	110	0	105	1045	490	2650

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.13: Alternative A: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres BLM Lands, Including Split Estate Federal Minerals, 2013–2027

Existing and Projected Wells – BLM Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	30	0	0	84	0	0
NSJB – Conventional	0	0	10	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	90	20	15	88	11	80
Paradox Basin – GSGP	0	0	27	153	16	106
Total	120	20	52	325	27	186
Existing and Projected Roads* – BLM Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	20	0	0	14	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	45	10	7	43	5	40
Paradox Basin – GSGP	0	0	13	76	8	53
Total	65	10	20	133	13	93
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	75	0	0	165	0	0
NSJB – Conventional	0	0	5	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	360	80	60	350	45	320
Paradox Basin – GSGP	0	0	205	1,165	120	805
Total	435	80	270	1,680	165	1125

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Alternative B (Preferred Alternative)

Alternative B is the preferred leasing alternative. Approximately 2,040,800 acres are available for lease, of which 1,032,230 acres are stipulated with TL, 1,133,320 acres stipulated with CSU, and approximately 1,097,500 acres stipulated with NSO. Areas that are administratively not available for leasing total approximately 136,073 acres. Table 3.19.11 presents leasing availability and stipulations that would apply to NFS and BLM-administered public lands in Alternative B.

Projected oil and gas development for the BLM and USFS combined under Alternative B (Table 3.19.14 and Table 3.19.15) includes approximately 575 well pads on future leases. Approximately, 90 well locations are projected to be non-productive and reclaimed after production testing. Projected GSGP formation well pads would total 410 on future leases.

Wells potentially displaced by NSO stipulations may total approximately 170. A total of 53 projected wells may be eliminated because their locations would be allocated to lands administratively not available for leasing.

Approximately 2,800 acres would be cleared to accommodate projected well pads and access roads.

Maps 50, 54, and 58 (Volume III, Appendix V) depict lands that are available for leasing, lands that are withdrawn from leasing, lands that are administratively not available for leasing, and the stipulations that apply to lands available for leasing under Alternative B.

Table 3.19.14: Alternative B: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on National Forest System Lands, 2013–2027

Existing and Projected Wells – NFS Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	32	0	0	255	0	0
NSJB – Conventional	0	0	30	0	0	0
San Juan Sag	0	0	5	0	25	0
Paradox Basin – Conventional	0	0	2	6	14	93
Paradox Basin – GSGP	0	0	8	59	42	279
Total	32	0	45	320	81	372
Existing and Projected Roads* – NFS Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	16	0	0	70	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	2	0	12	0
Paradox Basin – Conventional	0	0	1	3	7	46
Paradox Basin – GSGP	0	0	4	36	21	140
Total	16	0	7	109	40	186
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	110	0	0	585	0	0
NSJB – Conventional	0	0	15	0	0	0
San Juan Sag	0	0	20	0	100	0
Paradox Basin – Conventional	0	0	10	25	55	370
Paradox Basin – GSGP	0	0	60	435	320	2,120
Total	110	0	105	1,045	475	2,490

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.15: Alternative B: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on Bureau of Land Management Lands, Including Split Estate Federal Minerals, 2013–2027

Existing and Projected Wells – BLM Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	30	0	0	84	0	0
NSJB – Conventional	0	0	10	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	90	20	15	88	10	65
Paradox Basin – GSGP	120	0	27	153	10	70
Total	240	20	52	325	20	135
Existing and Projected Roads* – BLM Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	20	0	0	14	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	45	10	7	43	5	33
Paradox Basin – GSGP	0	0	13	76	5	35
Total	65	10	20	133	10	68
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	75	0	0	165	0	0
NSJB – Conventional	0	0	5	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	360	80	60	350	40	260
Paradox Basin – GSGP	0	0	205	1,165	76	532
Total	435	80	270	1,680	116	792

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Alternative C

Under leasing Alternative C, production of goods and services are less than proposed under leasing Alternatives A, B, and D.

Approximately 1,371,120 acres would be available for lease in Alternative C. Designated wilderness areas and the Piedra Area are withdrawn from leasing by law. Approximately 532,300 acres recommended for wilderness or WSR designation (wild river segments) are administratively not available for mineral leasing under Alternative C, the highest among the alternatives. Seventy percent of the areas proposed for withdrawal occurs in no or low potential areas. CRAs not recommended for wilderness in Alternative C are stipulated with NSO. On lands outside CRAs a full range of stipulations are assigned including stipulations such as TL, CSU, and NSO to protect various resources such as highly erosive soils, steep slopes, critical wildlife habitat, and areas with special management designations, such as archaeological areas, among others. Areas that are administratively not available for lease total approximately 873,100 acres.

Projected oil and gas development for the BLM and USFS combined under Alternative C includes approximately 570 well pads on future leases (Table 3.19.16 and Table 3.19.17). Approximately 90 well locations are projected to be non-productive and reclaimed after production testing. Projected GSGP well pads would total 405 on future leases.

Wells potentially displaced by NSO stipulations may total approximately 195, the greatest among the alternatives, and a total of 56 projected wells may be eliminated because their locations would be allocated to lands administratively not available for leasing.

Approximately 2,760 acres would be cleared to accommodate projected well pads and access roads on future leases.

Maps 51, 55, and 59 (Volume III, Appendix V) depict lands that are available for leasing, lands that are withdrawn from leasing, lands that are administratively not available for leasing, and the stipulations that apply to lands available for leasing under Alternative C.

Table 3.19.16: Alternative C: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on National Forest Service Lands, 2013–2027

Existing and Projected Wells – NFS Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	32	0	0	255	0	0
NSJB – Conventional	0	0	30	0	0	0
San Juan Sag	0	0	5	0	25	0
Paradox Basin – Conventional	0	0	2	6	10	69
Paradox Basin – GSGP	0	0	8	59	37	249
Total	32	0	45	320	72	318
Existing and Projected Roads* – NFS Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	16	0	0	70	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	2	0	12	0
Paradox Basin – Conventional	0	0	1	3	5	35
Paradox Basin – GSGP	0	0	4	36	17	125
Total	16	0	7	109	34	160
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	110	0	0	585	0	0
NSJB – Conventional	0	0	15	0	0	0
San Juan Sag	0	0	20	0	100	0
Paradox Basin – Conventional	0	0	10	25	40	280
Paradox Basin – GSGP	0	0	60	435	250	1,670
Total	110	0	105	1045	390	1,950

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.17: Alternative C: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on Bureau of Land Management Lands, Including Split Estate Federal Minerals, 2013–2027

Existing and Projected Wells – BLM Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	30	0	0	84	0	0
NSJB – Conventional	0	0	10	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	90	20	15	88	8	57
Paradox Basin – GSGP	0	0	27	153	10	63
Total	120	20	52	325	18	120
Existing and Projected Roads* – BLM Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	20	0	0	14	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	45	10	7	43	4	28
Paradox Basin – GSGP	0	0	13	76	5	32
Total	65	10	20	133	9	60
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	75	0	0	165	0	0
NSJB – Conventional	0	0	5	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	360	80	60	350	35	230
Paradox Basin – GSGP	0	0	205	1165	65	480
Total	435	80	270	1680	100	710

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Alternative D

Alternative D provides for a mix of multiple-use activities, with a primary emphasis on the "working forest and rangelands" concept in order to produce a higher level of commodity goods and services compared to the other alternatives. This alternative provides for the greatest extent of resource use within the planning area while, at the same time, protecting and sustaining resources. The oil and gas leasing program associated with Alternative D is described below.

Approximately 2,105,058 acres are available for lease in Alternative D, of which approximately 74,603 acres are stipulated with TL, 1,654,394 acres are stipulated with CSU, approximately 799,156 acres are stipulated with NSO, and 350,179 acres are stipulated with standard lease terms. Alternative D does not include any wilderness or WSR recommendations, and thus no proposal for lands to be withdrawn from leasing. CRAs are stipulated NSO in Alternative D. On lands outside IRAs, a full range of stipulations are assigned including TL, CSU, and NSO to protect various resources such as highly erosive soils, steep slopes, critical wildlife habitat, and areas with special management designations such as archaeological areas, among others (see Volume III, Appendix H).

Table 3.19.18 and Table 3.19.19 present leasing availability and stipulations for NFS and BLM-administered lands within Alternative D.

Projected oil and gas development of future leases for the BLM and USFS, combined under Alternative D includes 585 well pads (see Table 3.19.18 and Table 3.19.19). Of this total, approximately 85 wells are projected to be non-productive and would be reclaimed after production testing. Within the GSGP, 415 well pads would be constructed on future leases.

Wells potentially displaced by NSO stipulations may total approximately 150, and a total of 30 projected wells may be eliminated because their location would be allocated to lands administratively not available for leasing.

Approximately 2,850 acres would be cleared to accommodate projected well pads and access roads.

Maps 52, 56, and 60 (Volume III, Appendix V) depict lands that are available for leasing, lands that are withdrawn from leasing, lands that are administratively not available for leasing, and the stipulations that apply to lands available for leasing under Alternative D.

Table 3.19.18: Alternative D: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on National Forest Service Lands, 2013–2027

Existing and Projected Wells – NFS Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	32	0	0	255	0	0
NSJB – Conventional	0	0	30	0	0	0
San Juan Sag	0	0	5	0	25	0
Paradox Basin – Conventional	0	0	2	6	14	95
Paradox Basin – GSGP	0	0	8	59	44	297
Total	32	0	45	320	83	392
Existing and Projected Roads* – NFS Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	16	0	0	70	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	2	0	12	0
Paradox Basin – Conventional	0	0	1	3	7	47
Paradox Basin – GSGP	0	0	4	36	22	145
Total	16	0	7	109	41	192
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	110	0	0	585	0	0
NSJB – Conventional	0	0	15	0	0	0
San Juan Sag	0	0	20	0	100	0
Paradox Basin – Conventional	0	0	10	25	55	380
Paradox Basin – GSGP	0	0	60	435	335	2,255
Total	110	0	105	1,045	490	2,635

[*] Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.19: Alternative D: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on Bureau of Land Management Lands, Including Split Estate Federal Minerals, 2013–2027

Existing and Projected Wells – BLM Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	30	0	0	84	0	0
NSJB – Conventional	0	0	10	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	90	20	15	88	11	72
Paradox Basin – GSGP	0	0	27	153	11	100
Total	120	20	52	325	22	172
Existing and Projected Roads* – BLM Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	20	0	0	14	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	45	10	7	43	5	36
Paradox Basin – GSGP	0	0	13	76	5	50
Total	65	10	20	133	10	86
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	75	0	0	165	0	0
NSJB – Conventional	0	0	5	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	360	80	60	350	45	290
Paradox Basin – GSGP	0	0	205	1,165	45	760
Total	435	80	270	1,680	90	1050

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

No Leasing Alternative

The No Leasing Alternative is analyzed per direction in 36 CFR 228.102(c)(2)&(3), which requires the USFS, when considering oil and gas leasing, to analyze an alternative of not leasing. A No Leasing Alternative is also applied to BLM-administered public lands to achieve a consistent set of alternatives among the two land management agencies. Under the No Leasing Alternative, acres withdrawn from leasing total approximately 480,953 acres. The remaining NFS lands (1,381,559 acres) and BLM-administered lands (822,533 surface and subsurface acres) not withdrawn are administratively not available for leasing (Table 3.19.20). Under this alternative, existing leases would not be affected and would continue through their terms.

Table 3.19.20: Oil and Gas Leasing Availability in the Paradox Basin Analysis Area for the No Leasing Alternative

Planning Area	NFS	BLM	Federal Subsurface	Total
Federal mineral acres	1,863,394	503,464	319,089	2,642,052
Acres withdrawn from leasing	481,035	0	0	480,953
Acres proposed for withdrawal	0	0	0	0
Acres administratively not available for leasing	1,381,559	503,464	319,089	2,161,099
Acres available for leasing	0	0	0	0

Oil and gas development would occur on existing leases only. Approximately 830 well pads would be constructed and 2,300 acres would be cleared to accommodate well pads and access road construction (Table 3.19.21 and Table 3.19.22).

Map 61 (Volume III, Appendix V) depicts lands that are available for leasing, lands that are withdrawn from leasing, lands that are administratively not available for leasing, and the stipulations that apply to lands available for leasing under the No Leasing Alternative.

Table 3.19.21: No Leasing Alternative: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on National Forest Service Lands, 2013–2027

Existing and Projected Wells – NFS Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases		Projected Wells on Future Leases	
			Non-productive (reclaimed)	Production (long term)	Non-productive (reclaimed)	Production (long term)
NSJB – CBM	32	0	0	255	0	0
NSJB – Conventional	0	0	30	0	0	0
San Juan Sag	0	0	5	0	0	0
Paradox Basin – Conventional	0	0	2	6	0	0
Paradox Basin – GSGP	0	0	8	59	0	0
Total	32	0	45	320	0	0
Existing and Projected Roads* – NFS Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases**		**Projected Road Miles for Projected Wells on Future Leases**	
			Non-productive (reclaimed)	**Production (long term)**	**Non-productive (reclaimed)**	**Production (long term)**
NSJB – CBM	16	0	0	70	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	2	0	0	0
Paradox Basin – Conventional	0	0	1	3	0	0
Paradox Basin – GSGP	0	0	4	36	0	0
Total	16	0	7	109	0	0
Existing and Projected Disturbance Acres	**Existing Wells and Roads**		**Projected Disturbance Existing Leases**		**Projected Disturbance Future Leases**	
	Total Acres Disturbed	**Total Acres Projected to be Reclaimed**	**Non-productive Wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**	**Non-productive wells and Associated Roads (reclaimed)**	**Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	110	0	0	585	0	0
NSJB – Conventional	0	0	15	0	0	0
San Juan Sag	0	0	20	0	0	0
Paradox Basin – Conventional	0	0	10	25	0	0
Paradox Basin – GSGP	0	0	60	435	0	0
Total	110	0	105	1045	0	0

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Table 3.19.22: No Leasing Alternative: Projection of Well Pads and Access Road Miles, and Corresponding Disturbance Acres on Bureau of Land Management Lands, including Split Estate Federal Minerals, 2013–2027

Existing and Projected Wells – BLM Lands	Existing Producing Wells	Existing Well sites Projected to be Reclaimed (2013–2027)	Projected Wells on Existing Leases: Non-productive (reclaimed)	Projected Wells on Existing Leases: Production (long term)	Projected Wells on Future Leases: Non-productive (reclaimed)	Projected Wells on Future Leases: Production (long term)
NSJB – CBM	30	0	0	84	0	0
NSJB – Conventional	0	0	10	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	90	20	15	88	0	0
Paradox Basin – GSGP	0	0	27	153	0	0
Total	120	20	52	325	0	0
Existing and Projected Roads* – BLM Lands	**Existing Road Miles**	**Existing Road Miles Projected to be Reclaimed (2013–2027)**	**Projected Road Miles for Projected Wells on Existing Leases: Non-productive (reclaimed)**	**Projected Road Miles for Projected Wells on Existing Leases: Production (long term)**	**Projected Road Miles for Projected Wells on Future Leases: Non-productive (reclaimed)**	**Projected Road Miles for Projected Wells on Future Leases: Production (long term)**
NSJB – CBM	20	0	0	14	0	0
NSJB – Conventional	0	0	0	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	45	10	7	43	0	0
Paradox Basin – GSGP	0	0	13	76	0	0
Total	65	10	20	133	0	0
Existing and Projected Disturbance Acres	**Existing Wells and Roads: Total Acres Disturbed**	**Existing Wells and Roads: Total Acres Projected to be Reclaimed**	**Projected Disturbance Existing Leases: Non-productive Wells and Associated Roads (reclaimed)**	**Projected Disturbance Existing Leases: Total Acres Disturbed – Production Wells and Roads**	**Projected Disturbance Future Leases: Non-productive wells and Associated Roads (reclaimed)**	**Projected Disturbance Future Leases: Total Acres Disturbed – Production Wells and Roads**
NSJB – CBM	75	0	0	165	0	0
NSJB – Conventional	0	0	5	0	0	0
San Juan Sag	0	0	0	0	0	0
Paradox Basin – Conventional	360	80	60	350	0	0
Paradox Basin – GSGP	0	0	205	1,165	0	0
Total	435	80	270	1,680	0	0

* Only roads for administrative use (closed to public) are included. Pipelines are projected to be in road ROWs, so road disturbance acres include pipeline disturbance.

Effect of Land Management Emphasis and Physical and Biological Constraints on Leasing and Reasonably Foreseeable Development

This discussion focuses on the effects of land management emphasis and physical and biological constraints that place limits on oil and gas development activities. Key factors that affect oil and gas development potential include the acres available and unavailable for oil and gas development by alternative and acres administratively not available lease as acres of NSO, which constrain development. Hence this analysis includes evaluation of resource stipulation in terms of the constraints they impose on oil and gas development (particularly wells eliminated as a result of NSO stipulations). The baseline for this analysis is the RFD scenario, which is unconstrained. Evaluation of the alternatives is presented in terms of the number of well sites that would be eliminated as a result of the oil and gas leasing stipulations.

Leasable mineral resources would be considered unrecoverable in areas designated not available for leasing. They would also be considered unrecoverable in areas open to leasing but where surface use constraints prohibit development operations on areas larger than can be technically and economically developed from off-site locations.

All alternatives have NSO restrictions on a portion of lands available for mineral leasing, which preclude surface occupancy. Development of the mineral resources in these areas would require off-site methods such as directional drilling. The equipment and personnel for directional drilling increase development costs by at least 10% to 50%. Directional drilling also increases the risks of drilling problems (such as stuck casings) and diminished well production.

Effects of Major Resource Programs and Constraints on Reasonably Foreseeable Development

This section describes how oil and gas leasing and development may be affected by the proposed LRMP standards and guidelines and associated leasing stipulations developed specifically for physical and biological resource protection (for example, protection of steep slopes or wildlife habitats). Stipulations in addition to standard terms are made part of a lease when the planning record demonstrates the necessity for the stipulations. Land use plans serve as the primary vehicle for determining the necessity for lease stipulations (BLM Handbook H1624-1). Stipulations to be applied to new oil and gas leases issued under the revised LRMP were developed based on environmental protection objectives to achieve compatibility with other management objectives, resources, and activities. Appendix F includes a table of leasing stipulations by alternative and the amount of acres affected by each resource stipulation.

Effects from Air

Because direct, indirect, and cumulative impacts to air quality may result from oil and gas leasing and development, several standards and guidelines have been adopted to minimize or eliminate many air pollution emissions. In summary, the following standards apply to oil and gas activities: NO_x emissions limits apply to stationary engines; venting of saleable gases is prevented through green completions; leaks associated with production, transport, pipelines, pneumatics, and storage of hydrocarbons is reduced or prevented; and VOC emissions from separators and dehydrators is reduced or eliminated. The following guidelines apply to oil and gas activities: effective dust suppression should be applied to larger construction activities lasting longer than 5 days; venting of VOCs, hazardous air pollutants, and greenhouse gases is reduced or eliminated; collocation/ centralization of new facilities and/or liquid gathering systems and optimization of new engines would be used to minimize air quality impacts; and drill rig engines that meet the most current Tier 2–Tier 4

emission standards would be used. Occupancy and use for minerals purposes are not restricted by air management through stipulations. See Volume II, LRMP, for the complete list of air quality standards and guidelines.

It is not anticipated that the air quality standards and guidelines, as stated above, would create any impacts at the leasing stage. Additional cost may be incurred by the operator at the project level (drilling a well) as a result of requirements for green completion, dust mitigation, and other requirements. Should a single well project evolve into a field development project, additional cost may be incurred by the operator as a result of the standards and guidelines for compressors, emissions, pipelines, and other facilities or infrastructure.

Effects from Fish and Wildlife Management

Stipulations for wildlife are presented in Volume III, Appendix H. TL restricts drilling activities during critical periods, such as breeding and nesting periods, and usually extend over a specific distance from the site if activities could cause an adverse effect. NSO stipulations buffer areas such as nest and breeding sites from oil and gas activities.

Normally, TL applies to drilling, testing, and new construction phases of oil and gas development and not to operation and maintenance of production facilities. The objective is to prevent nest abandonment and reduced reproductive success. The effect would be that workover operations would have to be conducted outside the period of TL. This does not apply to emergency repairs.

The CSU stipulation usually restricts drilling and other activities within a specified distance from the area requiring protection and is applied if activities would likely result in degradation of habitat, abandonment, disruption, or other failure.

There are approximately 390,000 acres of the SJNF and TRFO, including split estate, where wildlife stipulations would be applied. The majority of the acreage has winter TL applied for protection of big game winter range.

Approximately 60% of the acreage of the Paradox Basin conventional gas play and 30% of the GSGP would have wildlife stipulations assigned to protect various wildlife species and their habitats. NSO stipulations would apply to approximately 20% of the Paradox conventional gas play and 12% of the GSGP.

The effects of wildlife stipulations on projected oil and gas development in the RFD areas would be minor. NSO would apply to approximately 10 well sites in the GSGP. There would be approximately 35 projected wells stipulated with TL and CSU in the SJNF portion of the Paradox Basin and as many as 100 wells stipulated TL or CSU in the GSGP. The TL restrictions would limit the time period in which well drilling and workovers could be completed. Approximately 2% of wells in the RFD areas would be affected by the NSO stipulations that apply to the RFD areas.

Effects from Water Management

An NSO stipulation has been developed to meet guidelines for water, wetlands, riparian, and floodplain areas. The NSO stipulation is applied to maintain water quality, hydrologic integrity, and riparian area and wetland composition, structure, and function. Access and other development and production-related facilities would be allowed subject to identified operational constraints. Areas adjacent to reservoirs and eligible WSR segments would be stipulated NSO.

The effects of water management stipulations on oil and gas development would be minor. Approximately four projected well sites would be stipulated NSO in the Paradox Basin conventional gas play and 15 to 20 wells stipulated NSO in the GSGP, totaling approximately 2% of the wells projected in the RFD scenario for the SJNF portion of the Paradox Basin and the San Juan Sag. An additional seven wells would be stipulated CSU for watershed protection.

Effects from Vegetation Management

The acreage where special vegetation resource stipulations apply totals approximately 25,000 acres in the planning area. Vegetation stipulation acres are highest in Alternative B, followed by Alternatives D, C, and A. Vegetation stipulations would apply to approximately 2% of the Paradox Basin conventional gas play and 7% of the GSGP.

An NSO stipulation is applied to old growth forests, proposed SBAs, and existing and proposed RNAs for the purpose of protecting those rare or unique vegetation types or forest structural representations. A CSU stipulation is applied to areas of known mapped invasive species infestations for the purpose of alerting lessees to that condition and the need to address it in Surface Use Plans of Operation.

The effects of vegetation stipulations on oil and gas leasing and potential development in the RFD areas would be minor. Vegetation resource stipulations would apply to approximately 1% of the Paradox Basin conventional gas play and 2% of the GSGP.

There would be no well sites eliminated as a result of the application of vegetation stipulations to projected oil and gas development areas. There would be no well sites stipulated as NSO in the Paradox Basin conventional gas play as a result of the vegetation stipulations in Alternatives A, B, C, and D. Approximately three well sites would be stipulated NSO in the GSGP area.

Effects from Soils Management

An NSO stipulation is applied to steep slopes over 35% and to other ecological land units listed below that have steep slopes and soil characteristics that are of high risk for mass waiting due to disturbance. In addition, the Gypsum Valley area is stipulated as CSU to protect highly erodible soils.

The effects of soil/geology protection stipulations on oil and gas development would be moderate. Approximately 14 projected well sites in the Paradox Basin conventional gas play would be stipulated NSO. An additional 11 wells within the same play would be stipulated CSU for soil/geology protection.

Within the GSGP, approximately 30 well sites would be stipulated NSO and 20 well sites stipulated CSU to protect steep slopes and sensitive soils.

Effects from Cultural, Heritage, and Historic Resource Management

The acreage to which heritage resource stipulations apply totals approximately 941 acres in Alternative A; 78,720 in Alternative B; 150,206 acres in Alternative C, and 78,120 acres in Alternative D.

Alternative A assigns an NSO stipulation to the Chimney Rock, Falls Creek, and Anasazi Archaeological Districts; otherwise, the three areas are administratively not available for leasing in the other alternatives. An NSO stipulation is applied to existing and proposed national register districts, national historic trails, and cultural areas designated as special interest areas because these features and their use and management would be incompatible with oil and gas development within their

immediate bounds. The number of acres assigned heritage management emphasis is greatest in Alternatives B and C, followed by Alternatives A and D.

The effects of heritage management stipulations on oil and gas leasing and potential development in the areas of RFD would be moderate. There would be approximately nine well sites eliminated in the Paradox Basin conventional gas play and 19 well sites eliminated within the Paradox Basin GSGP as a result of heritage protection stipulations. Well sites stipulated NSO would total approximately 10 in the GSGP under Alternatives B and C and fewer in Alternatives A and D.

Effects from Recreation and Scenery Management

Several NSO stipulations are applied to areas with objectives for scenic integrity protection and areas where well development would be incompatible with recreation areas, including developed recreation sites, ski areas, high SIO areas (VRM Class I and II), special designation trails, recreation-emphasis corridors, and scenic byways. CSU would be prescribed for designated SRMAs, which total approximately 130,000 acres in Alternatives B, C, and D. The CSU stipulation allows surface occupancy and use subject to operational constraints consistent with the desired recreational setting. Access and other development and production-related facilities would be allowed but may be moved or modified to preserve scenic resources. Operational constraints are similar to those utilized for scenery management and may include requirements that reduce recreational conflict, such as using topographic and vegetative screening, matching color tones of facilities with surrounding topographic features, orienting the well pad and facilities, redesigning production facilities to such scale that they may not be evident or blend with the vernacular architecture of the area, or placing facilities outside the affected area.

Effects of recreation protection stipulations are generally the same by alternative; no projected well sites would be eliminated by application of the NSO stipulations. Well sites stipulated by NSO would total approximately three wells on the BLM public lands and between 20 and 30 wells within the GSGP area, meaning the well location would have to be moved to accommodate the recreational use protected. In some instances, wells would have to be moved up to 0.25 mile.

Scenic integrity stipulations would apply to less than 1% of the Paradox Basin conventional gas play and 1% of the GSGP. Effects on the RFD scenario are generally the same by alternative; no projected well sites would be eliminated by application of the NSO stipulations. Where wells are stipulated as NSO, the well location would have to be moved to accommodate the visual quality of the area to be protected.

Effects from Range Management and Livestock Grazing

Guidelines for range management and livestock grazing do not require stipulations for oil and gas activities. Occupancy and use for minerals purposes are not restricted by range and livestock management activities. Certain grazing activities, such as grazing on mineral sites that are being reclaimed, are addressed in site-specific management requirements at the APD stage of development.

Effects from Fire and Fuels Management

Heavy equipment use during fire-suppression activities could affect buried pipelines; however, this is addressed in standard operating procedures and BMPs incorporated in the revised LRMP by reference. No stipulations are required.

Effects from Special Use Management

Generally no stipulations are required by guidelines for special uses; however, certain mineral-related activities (roads, pipelines, gathering lines, power lines) may require Special Use Permits and would be affected by guidelines for special uses. Guidelines applied to special use activities associated with oil and gas could increase operator costs. One category, administrative sites, is analyzed in this section. Administrative sites total 600 acres and would be assigned an NSO stipulation within an area inclusive of 0.25 mile of the administrative site. Application of this stipulation would not affect oil and gas development. There is sufficient flexibility in field siting of oil and gas facilities that administrative sites would not be affected.

Summary - Effects of Management Areas and Physical and Biological Stipulations on Reasonably Foreseeable Development Projection

The following discussion focuses on the differences between the alternatives in terms of the overall consequence of not available for lease and NSO requirements placed on the RFD scenario.

Decisions to not lease lands and stipulations applied by the various alternatives could affect well locations and could, in some cases, eliminate wells, resulting in only a portion of the RFD scenario’s implementation. The analysis of the effects of the lease determinations and stipulations applied to the RFD area suggests that approximately 235 well sites would be eliminated in Alternative C as a result of an administratively not available for lease decision and NSO requirements. Alternative A is followed by Alternative B (140 well sites), Alternative D (60 well sites), and Alternative A (33 well sites) for elimination. Well sites eliminated as a percentage of unconstrained RFD would total between 4% and 18% percent (Table 3.19.23 and Table 3.19.24).

Table 3.19.23: Projected Number of Wells on New and Existing Leases and Total Eliminated by Not Available for Lease or No Surface Occupancy Designations Where the Stipulation May Preclude Development Opportunities

Jurisdiction	Unconstrained	Alt A	Alt B	Alt C	Alt D	No Lease
SJNF (wells)	704	687	654	581	685	101
TRFO (wells)	630	614	540	518	590	351
Total (wells)	**1,334**	**1,301**	**1,194**	**1,099**	**1,275**	**452**
Wells Eliminated as a Result of the Alternatives						
Not available for lease	0	-16	-128	-199	-39	-882
NSO core not feasible for development	0	-17	-12	-36	-20	0
Percent reduction		**-4%**	**-11%**	**-18%**	**-5%**	**-66%**

Table 3.19.24: Projected Number of Well Pads and Total Eliminated by Not Available for Lease or No Surface Occupancy Designations Where the Stipulation May Preclude Development Opportunities

Jurisdiction	Unconstrained	Alt A	Alt B	Alt C	Alt D	No Lease
SJNF (well pads)	540	527	503	440	525	75
TRFO (well pads)	511	496	438	421	477	283
Total (well pads)	**1051**	**1,023**	**941**	**861**	**1002**	**358**
Well Pads Eliminated as a Result of the Alternatives						
Not available for lease	0	-15	-101	-163	-35	-713
NSO core not feasible for development	0	-13	-9	-27	-14	0
Percent reduction		**-4%**	**-11%**	**-18%**	**-5%**	**-66%**

Table 3.19.25 describes the number of well sites potentially displaced by NSO requirements, both in terms of relative number of sites and percentage of total projected well pads per alternative. Alternative C has the highest impact on oil and gas development opportunities, potentially displacing 465 wells, or 54% of total projected wells under the alternatives. Alternative C is followed in order by Alternatives B, A, and D in descending order of impact. A reasonable assumption is that offset locations may not be available in every case where well sites are displaced by NSO stipulations. Thereby, some percentage of the total wells displaced may be eliminated.

Table 3.19.25: Projected Number of Well Sites Potentially Displaced by No Surface Occupancy Requirements

Jurisdiction	Alt A	Alt B	Alt C	Alt D	No Lease
SJNF					
Conventional gas	51	53	52	43	0
GSGP	165	152	248	150	0
TRFO					
Conventional gas	15	22	65	8	0
GSGP	44	50	100	23	0
Total	**275**	**277**	**465**	**224**	**0**
Percentage of total well sites	**27%**	**30%**	**54%**	**22%**	**0%**

In terms of the overall impacts of the alternatives on RFD, Alternative C would eliminate a relative 18% of development potential and would require displacement of 54% of remaining wells. Alternative D would have the smallest impact relatively eliminating 5% of development potential and would require relocation of approximately 22% of remaining well sites due to NSO requirements.

3.20 Minerals and Energy: Solid Minerals

3.20.1 Introduction

Locatable minerals, mineral materials, and solid leasable minerals are all discussed in this section. Solid mineral resources within the TRFO and SJNF have played a significant role in the past and continue to be important today. Current resource estimates indicate valuable reserves within portions of the planning area. Solid minerals activity is most heavily concentrated on BLM lands in the Slick Rock area near Dove Creek and the associated Uravan Mineral Belt area; however, activity also occurs in the Silverton, Rico, and La Plata areas.

The BLM and USFS manage mineral-related activities consistent with multiple-use management principles. The exploration, development, and production of solid minerals resources are integrated with the use, conservation, and protection of other resources. The BLM also manages approximately 264,400 acres of federally owned mineral estate beneath privately held surface called split estate land.

Legal and Administrative Framework

Laws

- **The United States Mining Laws of 1872:** This act allows exploration, development, and production of minerals from mining claims on public lands.

- **The Building Stone Placer Act of 1890**: This act made building stone subject to location under placer claims.
- **The Organic Administration Act of 1897:** This act extends the operation of the U.S. Mining Laws to NFS lands reserved from the public domain.
- **Stock Raising Homestead Act of 1916:** Provided homesteads to settlers, but retained mineral rights to the federal government. BLM administers the federal minerals beneath these split estate lands.
- **The Mineral Leasing Act of 1920, as amended:** This act establishes the leasing system for the exploration and development of coal, phosphate, potassium, sodium, oil shale, oil, and gas.
- **The Department of Agriculture Organic Act of 1944:** This act provides for the protection and management of resources of NFS lands.
- **The Mineral Leasing Act for Acquired Lands of 1947:** This act extends the provisions of the mineral leasing laws to the mineral estate on lands acquired by the federal government, including so-called “hard rock” minerals, and requires the consent of the Secretaries of the Interior (BLM) and Agriculture (USFS) prior to leasing, as applicable.
- **The Common Varieties of Mineral Materials Act of 1947:** This act authorizes disposal of mineral materials such as sand, gravel, and common clay (as well as certain vegetative materials) through sale contracts or permits. It also allows free use by government agencies, municipalities, and non-profit organizations.
- **Multiple Mineral Development Act of 1954 (PL 585):** This act amended the mineral leasing and mining laws to allow for the development of multiple mineral development on the same tracts of public lands.
- **Federal Land Policy and Management Act of 1976:** FLPMA requires that mines submit reclamation plans provides penalties for undue or unnecessary degradation. The act requires that public lands be managed in a manner that recognizes the nation’s need for domestic sources of minerals, food, timber, and fiber from the public lands, including implementation of the Mining and Minerals Policy Act of 1970 (84 Stat. 1876, 30 USC 21a) as it pertains to public lands.
- **The Multiple Surface Use Mining Act of 1955 (PL 167):** This act prohibits the location of mining claims for common varieties of mineral materials (such as sand, gravel, and building stone) and provides direction for the multiple uses of surface resources of mining claims.
- **Mining and Minerals Policy Act of 1970:** This act states that, among other things, it “is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals.”
- **Geothermal Steam Act of 1970, as amended:** This act declared geothermal energy to be part of federal mineral estate and subject to leasing.
- **The Surface Mining Control and Reclamation Act of 1977:** This act allows the Secretary of Agriculture to enter into agreements with states in order to regulate surface coal mining operations on NFS lands. It also directs the Secretary of Agriculture to conduct a Coal Unsuitability Assessment in order to determine the suitability of NFS lands for surface coal mining operations.

- **Energy Policy Act of 2005:** This act gives policy guidance and makes changes to mining and leasing laws regarding oil and gas, coal, oil shale, tar sands, and geothermal energy.

Regulations and Policies

- **CFR 36 228A:** This requires mining claimants to file an operating plan or notice of intent for proposed mining activities on NFS lands.
- **CFR 36 228B:** Solid Leasable Minerals (Reserved)
- **CFR 36 228C:** This regulates the disposal of common variety mineral materials.
- **CFR 43 3400, 3500, 3600, and 3800:** These provide guidance for the management of coal, mineral materials, and solid leasable and locatable minerals for the BLM.

3.20.2 Affected Environment

Existing Conditions and Trends

Federally owned mineral resources are managed under three categories with differing sets of laws and regulations:

- **Locatable Minerals:** These are subject to claim under the Mining Law of 1872, as amended.
- **Saleable Mineral Materials (common variety):** These are disposable by discretionary direct sale or free use.
- **Leasable Minerals:** These are subject to lease under the Mineral Leasing Act of 1920, as amended. These include fluid leasables (oil and gas) and solid leasable minerals (non-energy minerals such as potash, sodium, phosphate, and other minerals, as well as coal).

For the purposes of this document, locatable minerals (including precious and base metals, as well as uranium and vanadium), saleable mineral materials (including sand, gravel, and construction stone), and some solid leasable minerals (including coal, potash, and sodium) are discussed as “solid minerals.” Oil and natural gas (including CO_2) are discussed together as “fluid leasable minerals.”

Locatable Minerals

Under the Mining Law of 1872, valuable deposits of minerals on public domain lands are subject to location (mining claims). Minerals subject to location are those not subsequently removed under this act and include deposits of precious metals (e.g., gold, silver, platinum), base metals (e.g., lead, zinc, copper, tin, antimony, cobalt), rare earth elements, uranium, vanadium, and uncommon varieties of mineral materials such as high purity limestone or gypsum.

The Mining Law of 1872 grants the public the right to prospect for, develop, and mine valuable deposits of locatable minerals on public domain lands open to mineral entry. It also allows the public to stake claims in order to establish exclusive possessory rights to explore and develop minerals in a defined area. Lands may be segregated or withdrawn based on mineral entry where there is an irreconcilable conflict between mineral extraction and other land uses. Segregations can be done administratively and are for a finite period of time. Withdrawals are generally done by congressional action.

The mining law provides for types of location: placer claims (alluvial minerals not formed in place such as gold-bearing gravels, and for uncommon varieties of stone), lode claims (for vein minerals, or minerals formed in place), and mill sites claims, which are for processing locatable minerals. Tunnel

sites are not a claim per se, but are staked as an exploratory ROW and are seldom used anymore because of advances in exploration drilling technology.

Placer Claims: The distribution of open (currently filed) placer claims indicates areas that are most likely to be impacted by placer mining disturbance. Gold is the most commonly mined placer mineral, although other minerals such as garnets, diamonds, and tin are sometimes placer mined. Gold is most likely the target of all of the placer claims in the planning area. Most claims are associated with alluvial deposits along stream channels and valley bottoms. Large-scale development of alluvium may have profound impacts on hydrology and valley bottom morphology. The current level of development on placer claims is low.

Lode Claims: Lode claims cover many types of mineral commodities within the planning area. Lode claim distributions, like placer claim distributions, are strong indicators of historic and potential interest and mining activity. The planning area has active lode claims associated with a variety of geological settings and mineral types. Some of these claims are concentrated in the same areas as those for placer claims discussed above (Silverton, the La Plata Mountains, and Rico). They involve the valley bottoms, as well as the headwaters areas, which are the sources of the precious minerals concentrated in the downstream placer claims. The Uravan Mineral Belt has a high concentration of lode claims for vanadium and uranium.

The remainder of the lode claims are scattered across the planning area and are typically isolated historical exploration or small development mining operations.

- Mill sites are for the milling and processing of minerals. They are up to 5 acres in size and must be staked on land that is non-mineral in character.
- Tunnel sites are mostly outdated exploratory tools that give the discoverer of any “blind lodes” encountered during the driving of the tunnel within 3,000 feet of its face the right to those minerals. Failure to work a tunnel for a 6-month period renders the tunnel site void. Tunnel sites are seldom used anymore, because core drilling is often cheaper and faster than tunneling.

Mining claim density can provide an important measure of historic and current interest in areas having potential for both lode and placer minerals, as summarized in Table 3.20.1. It is realized that claim density may also represent speculative interest in the area and may not define potential development. See Map 63 in Volume III, Appendix V for a depiction of locatable mineral potential in the planning area.

Locatable minerals can be mined by a wide variety of surface and underground methods. By staking a claim, a mining claimant is asserting that they have “discovered” a “valuable deposit” of a locatable minerals; however, the claimant does not have to specify in the mining claim records what mineral he or she asserts to have discovered. Claims for locatable minerals can be subject to patent if the claimant can prove that he or she has discovered a “valuable mineral deposit” that meets the requirements for patent; however, from 1995 until the time this document was published, Congress has annually passed a moratorium on the USDI spending any money to process patent applications, which has effectively banned patenting. It is not known whether Congress would continue with this ban in the future. Unpatented mining claims are considered to be a possessory right, and the BLM and USFS have limited discretion in processing mining and exploration proposals for locatable minerals; however, various environmental laws still apply.

Salable Minerals

Saleable minerals include (but are not limited to) common varieties of mineral materials such as sand and gravel, crushed stone, riprap, flag stone, ornamental stone, boulders, building stone, dimension stone, and common clay. They are generally mined using open pit or quarrying methods. Disposal of saleable minerals by the BLM or the USFS is discretionary and may occur in three ways: through the issuance of free use permits (available to government entities and non-profit organizations), through competitive sales contracts, and through non-competitive sales at fair market value. The BLM can make mineral materials available to the public through small sales contracts and may designate areas called “community pits” or “common use areas” for these small sales. Title to lands under mineral material contract remains with the federal government and cannot be patented as a result of the mineral material contract.

Solid Leasable Minerals

Solid leasable minerals are governed by the Mineral Leasing Act of 1920, as amended. This category includes most chlorides, sulfates, carbonates, borates, silicates, sulfates or nitrates of sodium or potassium and related products, phosphate and related minerals, and vein-type solid hydrocarbons (e.g., gilsonite). Hard rock minerals (i.e., minerals that would otherwise be locatable such as gold, silver, copper, uranium) on acquired lands (lands purchased by the federal government, rather than typical public domain lands) may also be subject to leasing. Leasable minerals are extracted by a broad array of extraction methods, including surface and underground mining methods as well as in-situ mining methods. The same surface use restrictions may be applied to solid leasable minerals as are applied to fluid leasable minerals. Coal is also a leasable mineral, but is also governed by several additional laws for leasing and development, which apply specifically to coal.

Coal: The USGS has reported on coal resources in the planning area (Kirschbau and Biewick 2009). Coal in the planning area found in the Upper Cretaceous formations. From oldest to youngest, they are the Dakota Sandstone Formation, the Menefee Formation, and the Fruitland Formation. There are two coal fields located in the planning area. They include a portion of the Nucla-Naturita coal field and the Durango-Pagosa Springs coal field.

The Nucla-Naturita coal field is located in the north-central and northwestern portions of the planning area. The coals are typically thin and discontinuous. They are considered to be of little interest for development.

There are several coal-bearing formations in the Durango-Pagosa Springs coal field. The coals were deposited throughout the San Juan Basin (Volume III, Appendix V, Map 62). They include Dakota Sandstone and the Menefee and Fruitland Formations. There is one coal seam in the Dakota, which can be as much as 8 feet thick. There are up to three coal zones in the Menefee. Seams in the Menefee range up to 9 feet thick. The Fruitland Formation has many beds; the composite thickness is estimated to be up to 40 feet thick.

Coals in the Menefee are considered to be high volatile A and B bituminous. The Fruitland coals are high volatile B and C bituminous. Sulfur content is low in both of these coals (0.7%–0.8% [Fruitland] and 0.6%–1.3% [Menefee]). The ash content is slightly higher in the Fruitland coals (19.5%–26.6% [Fruitland] as compared to 3.4%–16.6% [Menefee]).

Resource estimates in the Durango-Pagosa Springs field is estimated to be 13 billion short tons in the Menefee Formation. This estimate includes public and private lands but does not including resources

on tribal lands. The report also concluded that the coals near Pagosa Springs are thinner and dip at a steeper angle. This would make them less amenable to development.

In 1985, the King Coal mine was the only mine that had produced coal from public lands since 1975 (BLM 1985). Since it went into closure, the King Coal II mine (on an adjacent lease) has been the only other producing mine from public lands. The King Coal II is a relatively small mine; average production in 2012 was 700,000 tons/year. Coal from the mine is sent to the parent company's cement plants to be used in the process of making cement. In addition, the fly ash has favorable qualities for strengthening the cement. Some coal is also for several tourist train operations, including the Durango-Silverton Railroad.

The nearest rail loadout is in Gallup, New Mexico. This is a less than favorable option for coal transportation.

Oil Shale: The planning area has no known oil shale potential.

Department of Energy Uranium Lease Tracts: After World War II, the Atomic Energy Act gave the Secretary of the Interior the authority to withdraw specifically identified tracts of federal lands from location under the 1872 Mining Law specifically for uranium leasing and development,under leases to be administered by the Atomic Energy Commission. These uranium leases are now managed by the Department of Energy, the successor agency to the Atomic Energy Commission. The surface resources continue to be managed by the BLM, and the lands remain open to mineral leasing and mineral material sales, so long as they do not interfere substantially with uranium leases and/or development.

The USFS conducted an assessment of the potential for occurrence of mineral deposits (in relation to NFS lands, the results are summarized in Van Loenen and Gibbons [1997:1–9]). Solid minerals resource potential is based primarily on the geological setting and the interpretations regarding the likelihood that favorable rocks are present. These interpretations consider the results of previous studies, as well as mining history and production, geochemistry and geophysics, and data from mineral files. The attributes of known ore deposits and mineral occurrences were used to define favorable areas within permissive terrains in the planning area on NFS lands (Van Loenen et al. 1997:17–29). Types of solid minerals deposits by area and current activity are summarized in Table 3.20.1.

Table 3.20.1: Areas Favorable for Solid Minerals and Mineral Activity

Area	Mineral Type	Current Activity
Slick Rock/Dove Creek Uravan Mineral Belt	Uranium, vanadium (includes mining claims and DOE uranium lease tracts)	Mining claims, exploration, development
Utah Border – Lisbon area	Copper	Active mining adjacent to planning area
Rico-Dunton	Gold, silver, lead, zinc, copper, molybdenum	No current activity
Graysill	Vanadium	No current activity
La Plata	Gold, silver, lead, copper, possible platinum group elements	Minor underground mining and prospecting, mostly on patented lands
Most Animas, Dolores, La Plata, Piedra, San Juan Rivers and several major tributaries	Gold	Minor placer activity

Area	Mineral Type	Current Activity
Silverton	Gold, silver, lead, zinc, copper	Minor lode mining activity, mostly on patented lands
Needle Mountains	Gold, silver, copper, uranium	No current activity
Paradox Basin – western portion of planning area, salt diapirs	Sodium, potash, and related minerals	Proposed prospecting for potash
Chimney Rock (Durango Known Recoverable Coal Resource Area) and west planning area	Coal	No current activity
Paradox Rim Area	Coal	No current activity
Planning area-wide	Mineral materials: glacial deposits, talus slopes, road cuts, rock glaciers, fossil gravel terraces	Small-scale activity across planning area

High to moderate solid minerals potential also occurs within the Lizard Head wilderness (Mount Wilson/Navajo Basin area), the Weminuche wilderness area (Piedra headwaters area), and the South San Juan wilderness area (Quartz Creek area) (Van Loenen et al. 1997:31–44). These areas, however, are withdrawn from mineral entry under the terms of the Wilderness Act of 1964 and cannot be claimed or developed unless there are valid existing rights. Minimal mineral activity that is considered “recreational” in nature consists of exploration for, and recovery of, gold using hand-panning and small-diameter (less than 4-inch-diameter intake) suction dredging equipment. This activity typically does not result in significant environmental impacts and generally does not result in filing and development of mining claims. Small-diameter suction dredging in active stream channels is excluded from U.S. Army Corps of Engineers Section 404 permit requirements. These operations are typically not bonded and are monitored by the agency with jurisdiction over the affected land. The planning area averages approximately 10 such operations each year (typically during summer).

Background

Locatable Minerals

Historically, mineral exploration and development have played key roles in defining the character and landscape pattern within the planning area. The subregion is especially well endowed with locatable mineral resources. World-class deposits of precious and base metals occur along a northeast to southwest trend (from Aspen through Silverton, and Telluride southward to the La Plata Mountains). These deposits include massive sulfides, vein, and metallic replacement deposits largely associated with Tertiary-age volcanic centers.

Prospecting and mining in the San Juan Mountains dates back more than 130 years. The first recorded discovery of gold in this region was in 1848 in the Silverton area. This was followed by discoveries in the Durango and Rico areas in the 1860s. Mining of placer gold began in Summitville and Silverton in 1870 and along the La Plata River in 1873. Following a treaty with the Ute Indian Tribe in 1874, most of what is now the planning area was officially opened for mineral prospecting shortly thereafter. Lode deposits of gold and silver were discovered, and mined, from 1875 through 1900 in the Rico, La Plata, Needle Mountains, and Silverton areas.

During the mid-1890s, depletion of easily mined reserves, as well as the collapse of silver prices in 1893, resulted in most mining operations closing down. At the same time, workers developed local

coal deposits, which provided an important energy resource to mining and other industries, agriculture, and domestic needs. A new spike in metal mining and production occurred from 1900 to 1910, and continued at varying levels until the closure of gold mines by the government during World War II. After the war, new technologies and the growing economy spurred renewed mining within the region, although several mines never recovered Uranium mining in the Uravan Mineral Belt, which includes land along the Colorado-Utah border, as well as BLM lands in the western part of the planning area, began in 1898 with uranium ore being used to recover radium for luminescent pigment and other uses (Nelson-Moore et al. 1978). By World War 1, vanadium was being recovered for use as a steel hardener, with minor uses of uranium for a pigment. By World War II, uranium was being mined for atomic weapons. During the cold war, uranium and vanadium mining was booming, with several mills in the area. Uranium was one of the principle economic drivers of the region, providing employment for hundreds, if not thousands, from the late 1940s through the 1980s. By the late 1980s, most of the mining activity had died off. Today there are two permitted uranium mine complexes in the planning area, which are presently idle, as well as several notice-level exploration drilling projects.

Most locatable minerals claims for metals (other than uranium and vanadium) sites are not actively being mined; however, with record prices for gold, silver, and many base metals, the number of claims is likely to increase. Where these sites are on private land and privately owned minerals within the planning area (as a result of patenting of mining claims), the BLM or USFS have no jurisdiction over them within the patent boundaries. For operations on these private lands, the State of Colorado permits or regulates these operations. Streams influenced by mining on these sites may carry sedimentation and contamination downstream across the planning area and beyond (see Section 3.6, Water Resources).

Mining claim density can provide an important measure of historic and current interest in areas having potential for both lode and placer minerals, as summarized in Table 3.20.1. It is realized that claim density may also represent speculative interest in the area and may not define potential development.

Claimants do not have to indicate what mineral they have targeted on their claim, and a single claim gives the rights to any and all locatable minerals on that claim; however, the USFS and BLM can speculate what claims are most likely for, based on their location. In descending order of number of claims filed, the most common locatable mineral commodities claimed are uranium and vanadium, precious metals (gold and silver), and base metal (molybdenum, lead, copper, and zinc). Historically, base and precious metals were the most valuable of the locatable minerals. Today, however, they represent only a modest part of the current activity. The growing level of interest in uranium and vanadium indicates the importance of energy development in the region today.

Deposits of uranium and vanadium were discovered and mined in the in the turn of the twentieth century for radium, and then again during and after WW II at the Graysill (Rico) area and at the Uravan Mineral Belt area. By the mid-1970s, there was a reduced the demand for uranium. By the end of the Cold War, most uranium mining had ceased. Recent interest in nuclear power generation, as well as other demands, has kept the interest for uranium alive in the Uravan Mineral Belt.

Limestone valuable for certain chemical and industrial uses may be a locatable mineral. No development is currently active within the planning area; however, deposits of limestone that may meet this criteria occur throughout the planning area. The Animas River valley contains the most significant and most accessible resources. Historic proposals to mine this material led to the withdrawal of deposits in order to protect scenic values along the U.S. Highway 550 corridor. Demand for limestone for use as a chemical scrubber for coal-fired power plants may increase.

Solid Leasable Minerals (Non-energy)

Solid non-energy leasable minerals are identified in the Mineral Leasing Act and include potassium, sodium, phosphorus, vein hydrocarbons, and some hard rock minerals when located on acquired lands. Presently, the only non-energy solid leasable minerals that are known to exist with any abundance within the planning area are sodium and potash. Both of these minerals occur as evaporite salts in the Pennsylvanian-age Paradox formation in the western third of the planning area. The potential for either potassium or sodium salts in salt-cored anticlines is very high. The largest current area of interest is the Dolores Anticline, which stretches through the Glade area, across the Dolores River Canyon, through the Egnar area, and continues northwest to become the Lisbon Valley anticline. Presently there are 21 prospecting permit applications being evaluated for potash on the Dolores Anticline. Further to the north, Big Gypsum Valley and Little Gypsum Valley are salt anticlines where the salt-bearing Paradox Formation has actually forced its way to the surface. In these locations, the salt can be up to 14,000 feet thick. Because salt is soluble, much of the salt has been dissolved near the surface, leaving an insoluble residue of gypsum and dolomite and clay-rich soil. This, combined with intense structural deformation, could make mining potash more difficult in these valley locations. Historically a single mineral lease for sodium was issued in the Paradox Valley just north of the planning area. Brines were produced to use in the processing of uranium. No substantial deposits of other solid, non-energy minerals have been found within the planning area, though it is possible that they could exist.

Sodium and potassium may be produced in a variety of ways, including surface, underground, and solution mining. Near Carlsbad, New Mexico, potash is mined underground. In the Moab, Utah, area it is solution mined. The sodium and potassium in the planning area would be more likely candidates for solution mining, though other methods may be proposed depending on the location, depth, and geometry of any deposits that are found. Other minerals, such as lithium, calcium, and magnesium may be co-produced with sodium and potassium. Exploration for these minerals is conducted using a variety of conventional methods.

Under the 43 CFR 3500, the BLM is responsible for exploration, prospecting, leasing, and mining of federal solid non-energy leasable minerals. When these minerals occur on NFS lands, the USFS is responsible for surface management, and the BLM retains responsibility for mining and leasing decision. NEPA compliance is conducted jointly by both government entities, and the USFS makes a recommendation to the BLM regarding its preferred decision based on that NEPA analysis.

In the planning area, the same lands are open to oil and gas leasing and development that may be open to solid leasable minerals development, likely with the same restrictions on surface occupancy. Deep exploration drilling projects, and drilling of production wells for solution mining, are likely to use equipment very similar to oil and gas drilling. It is within the BLM's discretion to use applicable oil and gas planning guidance to advise decision-making for these solid leasable minerals. Additionally, applicable oil and gas policy and regulation may be adopted as COAs for solid leasable minerals permits, licenses, and leases.

Coal

Within the planning area, coal occurs along the margins of the Paradox and San Juan Basins. These outcrops are of late Cretaceous and early Tertiary age.

Coal has been produced in Colorado, New Mexico, and Utah since the middle of the nineteenth century. Due to the expansion of the railroads in the region, coal production in Colorado expanded to become the largest in the West. Production in all three states grew from the turn of the twentieth

century, to a peak prior to the Great Depression. Production tapered off through the war years and 1950s, with a resurgence beginning in the 1970s.

Historically, small underground and surface mines that support local markets followed the northern edge of the San Juan Basin between Cortez and Durango east to Pagosa Springs (more or less along the U.S. Highway 160 corridor), and north to Dove Creek. These mines, and related prospects, are largely abandoned. There are currently several coal mines operating in, or adjacent to, the planning area. More recently, large-scale mines have been developed in the region outside the planning area in order to feed regional power generation needs.

Coal Unsuitability Assessment: Under the terms of the Surface Mining Control and Reclamation Act of 1977, the SJNF and BLM conducted coal unsuitability assessments to determine the suitability of lands for TRFO surface coal mining, leasing and development operations. Twenty unsuitability criteria and appropriate exceptions and exemptions were applied to the Durango, East Cortez and Menefee Known Recoverable Coal Resource Areas (KRCRA) as identified by the USGS. In summary, 13,400 acres (9%) of the Durango KRCRA, 720 acres (25%) of the East Cortez KRCRA, and 80 acres (100%) of the Menefee KRCRA were identified as unsuitable for surface coal mining operations. Based on the unsuitability assessments (SJNF 1983; BLM 1985), 46,000 acres (31%) of the Durango KRCRA are identified as acceptable for further consideration for coal leasing, with an estimated reserve of 1.5 billion tons. One existing surface coal mine in the Durango KRCRA (Chimney Rock Coal Mine) with operations on both NFS and BLM lands was already in the lease extension application process during the unsuitability assessments. This application was denied for environmental reasons in 1985. Operations at the mine were terminated and the mine site has been reclaimed. The existing BLM and USFS coal unsuitability assessments for this LRMP revision found that the need does not exist to revise the assessments.

<u>Saleable Mineral Materials</u>

Common varieties of mineral materials are often referred to as saleable minerals and include such resources as sand, gravel, and stone. These minerals are used for building materials, aggregate, bulk fill, riprap, road surfacing, decoration, and landscaping. Disposal of these materials is discretionary; the public does not have a statutory right to these materials, prior to the issuance of a contract.

Deposits of limestone and aggregates were developed in order to build railroads, roads, and provide a source for concrete along with clay for brick and ceramics. Today, common variety mineral (including sand and gravel) development continues to be important in the subregion, as well as in the surrounding western states.

The SJNF has conducted an assessment of the potential for occurrence of mineral material deposits (Van Loenen et al. 1997:131–132), as summarized below. In addition, the BLM has also summarized potential mineral material locations.

Unlike most locatable minerals, deposits of common variety mineral materials occur everywhere, by default. Common sites for natural concentrations of small to large amounts of such materials are canyon walls, stream channels, talus slopes, landslides, ancient river terraces, glacial moraines, and floodplains. Road cuts, quarries, and pits increase the amount of material available for extraction.

Areas with known resources, or areas that are favorable for resources of sand and gravel, may contain materials that are ready for use or that are suitable for screening, washing, or crushing in order to meet size or fine-material requirements. Areas of Quaternary-age alluvium, colluvium, and glacial drift, as well as areas of river terrace deposits, contain sand and gravel suitable for use with

minimal treatment. Talus slopes of late Cretaceous and Tertiary-age igneous rock produce material suitable for crushing, lightweight aggregate, and dimension stone. Late Cretaceous and Tertiary-age igneous intrusives produce dimension stone and large aggregate. Late Cretaceous sedimentary rock produces dimension stone and aggregates.

Large boulders are found throughout the planning area in stream deposits, glacial drift, till, landslides, and floodplains. Most are found at higher elevations, and those closest to existing roads are primary targets for purchase.

Mineral materials constitute an administrative class largely made up of sand and gravel borrow pits and large-scale operations. These operations are typically correlated to roadways and valley bottom settings with alluvial deposits.

Currently, the planning area has approximately 20 active sand and gravel sites. Most mineral materials are collected from road cuts, stream channel banks, or alluvial deposits; therefore, the sites typically are located in valley bottoms. Ute Creek, the Animas River, and San Juan River above Pagosa Springs have active sites.

Free use permits for mineral materials may be issued to government entities—such as county road and bridge departments—or to non-profit organizations. Additionally, the BLM and USFS both use substantial amounts of mineral materials, primarily sand, grave, and boulders.

Trends

The trends noted in previous LRMPs have not changed dramatically, except for the renewed interest in uranium/vanadium mining (both as locatable mining claims and as DOE uranium leases) and interest in potash. However, changes in pricing factors may rapidly alter the level of interest in development of most mineral commodities. A substantial increase in demand for minerals may increase the filing and development of mining claims in established mining districts and areas once considered marginal. This, in turn, would result in increased conflict with other land and resource values and uses; initiate new administrative, political, and legal issues in choosing management priorities; generate public concerns over changing management; place economic pressures on managers and local communities; place local values against regional or national needs; and generate demands to answer all of these concerns within a short time period.

<u>Locatable Minerals</u>

The demand for mineral resources is driven by price, which, in turn, is governed by improvements in technology of exploration, production, refining, transportation, manufacture, and use; changes in lifestyle; changes in regulation and availability of land and access; changes in patterns of supply and demand (both domestically and internationally); and changes in national policy areas (including military conflict, security, and strategic reserves). The planning area has reserves of precious metals used for industrial, cosmetic, and investment purposes, as well as base metals (copper, lead, zinc, molybdenum, tin, tungsten, bismuth, and tellurium) used for a variety of industrial purposes. Exploration drilling of these deposits is a distinct possibility. The planning area has resources of uranium used for domestic power generation, medicine, and weapons, as well as vanadium used in steel production and batteries. Currently, important locatable mineral interests within the planning area are limited to uranium and vanadium (in the Dove Creek area). The increasing interest in nuclear power generation, as well as the need for vanadium (a byproduct of uranium development), for modern energy, air, space, power, and weapons technology could rapidly increase the demand for uranium exploration, development, and processing. High gold prices have increased the number of

mining claims in the area; however, no substantial gold mining or exploration projects on public lands have come to fruition in the recent past, but continued high prices would likely mean that there would be increased exploration and development in the near future. Demand for limestone for use as a chemical scrubber for coal-fired power plants may increase.

Demand for uranium increased significantly in the last several years. Long term it is possible that the demand for uranium would continue to grow, as non-fossil fuel resources are sought and as stockpiles are depleted.

The price of gold remained at or below $400 per ounce from the early 1990s through 2004. At these low prices, interest in gold mining waned considerably, and many marginal mines shut down nationwide. In 2004 prices began to climb and by September 2011 it had reached nearly $1,900 per ounce before dropping back to the $1,600-per-ounce range by March 2012. Silver and other precious metals prices have also climbed. New claims (presumably) for gold have begun to be staked in the planning area, but so far no major mining or exploration proposals have occurred.

Locatable minerals are subject to claim and development under the Mining Law of 1872. Management options may be somewhat limited once claims are filed on valuable mineral deposits; however, mining proposals must still be in compliance with state and federal environmental laws and regulations.

A growing interest in small recreational gold placer operations exists throughout the planning area and nationwide.

In areas where land managers have determined that the potential value of the mineral estate does not justify the environmental impacts of development, the surface management agency may propose withdrawal of the land from operation.

<u>Saleable Mineral Materials</u>

Issuance of mineral material permits is discretionary. Federal management options for these materials are, therefore, broad. Planning for development of mineral material sites can be undertaken independent of outside pressure and phased in order to meet demand as it grows. Demands for new types of mineral materials (such as boulders for river renovation projects) can be assessed before these resources are removed.

Within the planning area, demand for small amounts of hand-collected decorative and landscape stone can be met. The competition for gravel and aggregate may likely result in more development of quarries and pits within the planning area, as well as on adjacent private lands (and preference for planning area reserves to be used only for local, state, and federal road agencies).

The economic downturn of 2008 greatly decreased the demand for mineral materials, particularly construction aggregates and building stone. However, when the market picks back up, increasing construction in all area communities is creating a growing demand for aggregate and fill materials, as well as for decorative and landscaping stone. The building of new roads and the maintenance and improvement of existing roads may create increasing demand for aggregate for asphalt and cement and gravel for road surfaces. Large boulders are a growing target for purchase (for landscaping and river improvement projects). Law dictates that mineral materials be sold at fair market value. When fair market value is not known, one must be determined using the costs of comparable materials.

Solid Leasable Minerals

Growing world populations and shrinking supplies of fossil fuels are both likely to increase the need for fertilizer in the near future. Phosphate and potash are both leasable minerals and are two of the three main ingredients in fertilizer (along with nitrogen). Potash is the only one of these minerals with any potential to be found in commercially viable quantities. Presently only exploration and prospecting has been proposed for potash. If viable deposits are proved up by exploration, leasing and development could occur in the not-too-distant future. Solution mining presently seems like the most likely development method. Solution mining involves using deep wells to selectively dissolve potash from evaporite beds and pump potash-saturated brines to the surface where the potash can be recovered through some sort of desiccation process. Sodium, too, is a solid leasable mineral and has been produced nearby.

Issuance of leases for solid, non-energy minerals is also discretionary. In this document, solid leasable minerals are generally available in the planning areas that are open to oil and gas leasing and development, and the same surface use restrictions (excluding any applications under consideration at the time of this document is released) may apply.

Coal

Coal is disposed of under the federal coal leasing program. The SJNF and TRFO must review and approve issuance of leases for coal development. Although it cannot be known with certainty when lease applications would be filed and development plans proposed, the agencies can schedule the required analysis process in order to accommodate the workload, as needed.

In relation to the planning area, Durango is the only area with current coal production, which is expected to continue or increase. However, lack of rail lines and small reserves in the eastern (Pagosa) portion of the planning area may limit the potential for significant expansion. There is low potential for small, local markets to redevelop. Coal use for home and small business heating is not likely to increase without significant improvements in environmental protection technology and cost-competitiveness. This may limit the potential for small mining operations to resume operations.

Within the Durango and Menefee KRCRAs, it is unlikely that formerly developed coal deposits would be in demand for renewed development. Substantial new coal deposits are not likely to be discovered or proposed for development.

3.20.3 Environmental Consequences

Direct and Indirect Impacts

The environmental impacts related to the development of mineral resources would result primarily from different methods of extraction. Solid minerals are generally developed by mining methods, open pit or underground mining, or solution mining, which is sometimes called in situ recovery,

The expected environmental impacts related to current and projected solid minerals development activity levels within the planning area are discussed in detail in specific resource program sections of this chapter. This section considers the impacts of implementation of other resource activities on the SJNF and TRFO solid minerals programs.

Under each alternative, impacts are quantified based on the number of acres of land, which are restricted (requiring higher costs) or are not available for solid minerals operations (including mine and support facilities, pits, stockpile and equipment storage areas, mills, waste sites) or for

construction and use of access roads. Relatively concentrated impacts related to solid minerals development are associated with the mine or processing mill facilities. They would generally require one or two access roads, one utility corridor, and few, if any, disturbed areas away from the mine or mill. Future solid minerals activity cannot be predicted as to specific location, scale, or timing; therefore, the most reasonable way to estimate the impacts of alternatives on this potential future activity would be to consider the amount of land that is restricted or unavailable for possible use.

General Impacts

Impacts to the solid minerals program resulting from the implementation of the alternatives could result in the limitation of some areas to mineral activity and increased operating costs (through limitations on road construction and use, facility placement, and operational constraints). These impacts may result from the requirements imposed by other resource programs.

This estimate of impacts would be considered in conjunction with areas where solid minerals potential is known, or is suspected, to exist. Lands may be unavailable for solid mineral activity; however, if the mineral resource does not exist on those lands, any possible impacts from limiting access to those lands may be minor or negligible. The areas most likely to be impacted by the implementation of any of the alternatives (because of potential for solid minerals resources being present) are described in Table 3.20.1.

The Slick Rock/Dove Creek area and associated Uravan Mineral Belt area has a high potential for continued increased uranium and vanadium mining and milling activity. The Dolores and West Dolores River corridors, the Rico/Dunton area, the La Plata Mountains, and the Silverton area have potential for renewed precious and base metal development activity, the Graysill and Elk Park areas have potential for renewed exploration activity for uranium and vanadium. Market prices, commodity supply and demand, and technological advances may influence future interest in exploration, development, and production. Salable mineral sources occur throughout the planning area. The demand for gravel may increase as campgrounds and public and county roads are improved. (Sources to meet expected private needs are available outside the public lands.)

The following table lists the acres of land with moderate to high potential for solid locatable, saleable, and leasable mineral occurrence, coupled with alternative management that would prohibit or restrict development of those resources, if fully implemented. For this analysis, it is assumed that land designations recommended by any of the alternatives that would occur in the future (or are outside the authority of the USFS or BLM) would be implemented as recommended by the SJNF and TRFO. (For example, designation of additional wilderness areas would not lie within agency authority, and agency recommendations for additional wilderness areas may never be acted upon; however, this analysis assumes that such designation would occur within the planning period and that the recommended wilderness areas additions would be withdrawn from leasable mineral entry and development).

Land management actions or recommendations that are proposed within existing withdrawn lands (such as designated wilderness areas) are not considered. This is because the implementation of those proposed new designations would have no impact on lands already withdrawn. Similarly, those land management actions or recommendations under the alternatives that do not impact areas with moderate to high potential for the occurrence of solid mineral resources (see Table 3.20.2) are not considered. The impacts related to “proposed withdrawal acres” include only those proposed designations or areas outside existing wilderness areas and the Piedra Area.

Table 3.20.2: Moderate to High Potential Acres within Areas Proposed to be Petitioned for Withdraw

Proposed Withdrawal Areas with Moderate to High Potential	Alternative A	Alternative B	Alternative C	Alternative D
Recommended wilderness	N/A	50,266	511,578	N/A
Lands with wilderness characteristics	N/A	N/A	13,519	N/A
Wild segments of WSRs	N/A	15,929	16,063	N/A
Dolores River Canyon	N/A	N/A	38,205	N/A
Mesa Verde Escarpment	N/A	N/A	7384	N/A

Under all of the alternatives, development of salable mineral materials would be impacted based on the number of acres restricted or recommended for closure to mineral activity since development of these solid minerals resources is discretionary. Locatable minerals subject to claim under the Mining Law of 1872 would not be similarly impacted under all of the alternatives. Unlike mineral materials, which occur throughout the planning area, significant deposits of locatable solid minerals are unlikely to occur outside the areas identified in Table 3.20.1; therefore, impacts to this resource under any of the alternatives may be minor. Impacts to DOE uranium lease tracts would not vary by alternative since these lease tracts are administered by the DOE and are not subject to any of the alternatives. Locatable uranium/vanadium development may be impacted by restrictions related to protection of sage-grouse since the most important uranium/vanadium deposits are in the same geographic area. As noted above, these impacts are not intended to be read as absolute numbers; rather, they serve to indicate the relative restrictive nature of each alternative.

In summary, based on the total acres of the various management actions designations that could limit the development of some solid minerals, Alternative C may result in moderate to minor impacts, followed by Alternatives B, D, and A.

Impacts Related to Wilderness Area Management

Impacts related to wilderness area management may be the possible closure of designated areas to new solid minerals operations. The measurable indicator of impacts would be the number of acres allocated to MA 1 (proposed wilderness area) that contain areas of moderate or high potential for occurrence of solid minerals. These areas carry an assumption of closure by withdrawal or administrative action from new solid mineral exploration and development (although existing valid claims may allow mineral development). Although withdrawal may not occur without further environmental analysis and decision-making, it is assumed that withdrawal would be implemented, as recommended by the SJNF or TRFO. BLM WSAs in the Slick Rock/Dove Creek area would not impact future uranium and vanadium activity (since these areas are open to mineral development).

Alternative C may result in moderate impacts on solid minerals (due to wilderness area management), followed by moderate impacts under Alternative B. Alternatives A and D may result in no impacts.

Impacts Related to New Research Natural Area Designations

Impacts related to new RNA designations may be the possible closure of areas to solid minerals operations. The proposed Grizzly Peak and Hermosa RNAs may impact areas with moderate potential for precious and base metal locatable mineral activity.

The measurable indicator of impacts would be the number of acres allocated to proposed RNAs (because RNA designation carries an assumption of closure by withdrawal from solid minerals exploration and development). Withdrawal would not occur without further environmental analysis and decision-making; therefore, it is assumed that withdrawal would be implemented, as recommended by the SJNF or TRFO.

Alternatives B and C may result in minor impacts to solid minerals (due to new RNA designations). Alternatives A and D may result in no impacts.

Impacts Related to Wild and Scenic River Designations

Under the WSR program, designation of river segments as recreational or scenic do not carry constraints on locatable solid mineral activity; however, designation of a river segment as a WSR would carry an assumption that the segment would be withdrawn from new mineral activity. Impacts related to WSR designations may be the closure of areas to discretionary solid minerals operations. Designation of segments of the upper Dolores River may impact lands with high potential for uranium, vanadium, and precious metal resources. DOE uranium lease tracts in this river corridor would not be impacted. The Hermosa River, and tributaries, has moderate potential for precious and base metal occurrences, although there is no current activity.

The measurable indicator of impacts would be the number of miles allocated to suitable WSR designation. Although withdrawal would not occur without further environmental analysis and decision-making, it is assumed that withdrawal would be implemented, as recommended by the SJNF or TRFO.

Alternative B may result in minor impacts to solid minerals (due to WSR designation). Alternatives C and A may result in minor to negligible impacts. Alternative D may result in no impacts.

Impact Related to Wildlife and Fisheries Management

Impacts related to wildlife and fisheries management may be higher operating costs and the possible closure of areas to new solid minerals operations. Wildlife management activities that trigger these impacts would be primarily related to management requirements under the ESA. Protective measures applied to exploration and development activities may increase costs. Prevention from, and remediation of, acid mine drainage would be the most important factor for the Silverton area. These measures would be required by law and would not change under any alternative. Sage-grouse habitat protection may impact the development of mining claims in the Uravan Mineral Belt (uranium/vanadium) resource area. TRFO lands and DOE uranium leases would be subject to ESA regulation under any of the alternatives; however, such regulation is not within the management authority of the BLM. The degree of the impacts on federal minerals under the BLM's jurisdiction would depend on approved conservation strategies, critical habitat designations, and BOs that mandate specific management requirements for solid minerals exploration and development.

The measurable indicator of impacts would be the number of acres allocated to sage-grouse habitat (see Table 3.20.2). This is because this designation is known and could impact an area of current solid minerals activity (the Slick Rock/Dove Creek uranium/vanadium area) and potentially the solid leasable minerals in the same area. However, its usefulness is as a comparative indicator of impacts, not as an absolute quantifier. Alternatives that would allocate a greater number of acres to this designation may be considered to require a similar degree of restriction on solid minerals activity throughout the planning area, for comparison purposes.

Alternatives C, D, and B may all result in moderate to minor impacts on solid minerals from wildlife and fisheries management. Alternative A may result in no impacts.

Summary of Direct and Indirect Impacts by Alternative

Based on the total acres of the various management actions that could limit the development of solid minerals, Alternative C may result in moderate to minor impacts, followed by Alternatives B, D, and A, all with minor to negligible impacts.

Cumulative Impacts

Cumulative impacts, in relation to the alternatives, would result from a continuation of the same general restrictions on the solid minerals program that existed in the previous LRMP/RMP (BLM 1985; USFS 1983), as well as from the imposition of newer environmental laws and regulations. Table 3.20.2 above summarizes the direct and indirect impacts by alternative; expected cumulative impacts may follow the same pattern by alternative.

Solid minerals activity is scattered and intermittent in location and timing. The intensity of activities, both in numbers and intensity, is expected to be greater in areas of high mineral potential. Future solid minerals activity outside those specific areas would continue this pattern; as previous activities end, others would begin. The general level of activity would remain roughly the same; therefore, the cumulative impacts on the program and resource from implementation of any of the alternatives on lands with low or no potential for solid minerals may be negligible.

For the precious and base metal resource areas identified in Table 3.20.1, the legacy of past activities may exert an influence on future impacts to the solid minerals program. These past impacts, as well as changes in environmental law, restrictions on new operations and more potential closures to future activities, would be coupled with the higher costs of exploration, development, and reclamation. This may limit the success of new developments and of marginal operations, reducing the long-term supply of these metals to the local economy and to the nation. Where applicable, the designation of additional lands for WSAs, RNAs, and WSRs could restrict, withdraw, or make lands administratively unavailable for resource recovery for precious and base metals. However, the expected level of future development in these areas is moderate; therefore, the cumulative impacts on the precious and base metal program and resource from the implementation of any of the alternatives may be minor to moderate for such areas.

For the uranium/vanadium resource areas identified in Table 3.20.1, historic and current activity may not be a strong influence on future activity. Ongoing activity may operate under “grandfathered” existing approved mine plans; however, new mine plans or modifications may fall under modern restrictions. Some historic uranium activity has been cleaned up but there are still many unmitigated historic sites. The visible legacy of disturbance that typifies precious metal resource areas (such as Silverton) still exists, although many of those sites have also be cleaned up or mitigated. Because of this, the BLM and USFS have an active abandoned mined lands program. DOE uranium lease tracts are not subject to any of the alternatives. WSAs would be open to locatable mineral development. Areas open to development would face more stringent restrictions and higher costs than in the past. The cumulative impacts on the uranium/vanadium program and resource may be minor to moderate.

Overall, for the solid minerals resource, Alternative C may result in moderate to minor cumulative impacts. Alternatives B and D may result in minor impacts. Alternative A may result in negligible cumulative impacts.

3.21 Minerals and Energy: Alternative Energy

3.21.1 Introduction

Public lands have long provided energy resources for both individual and commercial use. The National Energy Policy has laid the legal groundwork for alternative energy projects on public lands; however, little demand has surfaced in relation to the planning area. Nonetheless, this planning effort addresses alternative energy development in order to offer guidance for projects that are proposed on the SJNF or TRFO.

Legal and Administrative Framework

Executive Orders

- EO 13212 of May 2001: This EO requires federal agencies to take appropriate actions, to the extent consistent with applicable law, to expedite projects that serve to increase the production, transmission, or conservation of energy.

Geothermal Regulations

- Energy Policy Act of 2005 (PL 109-58)
- **36 CFR 228 E**
- **Geothermal Steam Act of 1970** (PL 91-581; 30 USC 1001–1027, December 24, 1970, as amended 1977, 1988, and 1993).
- **43 CFR 3200:** This provides guidance for management of geothermal leases on BLM-administered lands

Wind

- The BLM's Wind Energy ROD - Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments, December 2005 (BLM 2005d, 2009c)
- BLM IM 2009-043, Wind Energy Development Policy (BLM 2009d)

Solar

- BLM IM 2007-097, Solar Energy Development Policy (BLM 2007f)
- The Solar Energy Development PEIS is being prepared by the DOE, Energy Efficiency and Renewable Energy Program, and the BLM; the PEIS will document solar guidance and BMPs (Solar Energy Development PEIS Information Center 2013).

Biomass

- The USFS Woody Biomass Utilization Desk Guide, National Technology and Development Program 2400—Forest Management, September 2007 (USFS 2007b)

Existing land use plans identify wilderness areas and WSAs, ACECs, RNAs, VRM classes, national scenic and historic trails, critical habitat areas, and other special management areas where land use restrictions apply to a variety of uses, including those related to alternative energy site testing and monitoring.

3.21.2 Affected Environment

Existing Conditions and Trends

The DOE National Renewable Energy Laboratory produced an analysis assessing the potential for renewable energy on public lands (BLM and DOE 2003). This renewable resource assessment addressed BLM, BIA, and NFS lands in the western United States, except Alaska. The assessment summarized high potential for five renewable energy uses: concentrated solar power and photovoltaics, wind, biomass, and geothermal. The planning area was identified as only having high potential for biomass energy production (see Table 3.21.1).

Table 3.21.1: BLM Planning Areas in Colorado with High Potential for Wind or Biomass Renewable Power

Planning Unit	Wind	Biomass
Grand Junction	High potential	–
Kremmling	High potential	High potential
Little Snake	–	High potential
Royal Gorge	High potential	High potential
San Juan (now TRFO)	–	High potential
Source: BLM and DOE 2003		

Within the planning area, there is currently no demand for use of public lands for commercial geothermal, wind, or solar power development or for the commercial use of biomass material. Personal use of firewood continues at a steady pace. Fuels reduction projects around communities in the planning area would provide a source of biomass for the development of a new local source of energy. Potential for commercial development in western Colorado is limited.

Geothermal

The potential recoverable energy contained within the known geothermal resource areas is small relative to the other fluid energy sources (including oil and natural gas) within the planning area. High-temperature geothermal resources are required for electricity generation. Extensive low- and moderate-temperature geothermal resources support agricultural, municipal, commercial, and residential uses. The geothermal fluid resources that occur within the planning area are of low or medium temperature. They emanate from geysers, springs, and wells and are generally adjacent to faults that serve as conduits for the upward flow of groundwater that has been heated by deep circulation from mainly volcanic sources.

Within the planning area, two types of geothermal resources are being commercially tapped: hydrothermal fluid resources and Earth energy. Hydrothermal fluid resources provide hot water for spa and pool use, as well as for space heating. Earth energy (the heat contained in soil and rocks at shallow depths) is excellent for direct use, as well as in connection with geothermal heat pumps. Within the planning area, the potential for additional noteworthy development of known hydrothermal resources, as well as for locating the presence of undiscovered hydrothermal resources, is slight.

The development of geothermal resources may increase slightly during the planning period. Most demand would involve non-federal lands, due to the proximity between the source of the energy and the facility to be supplied. The BLM and USFS would review, and approve, any plans of operation for

geothermal development within the planning area and would apply the appropriate environmental protection measures, as well as monitor for compliance.

Geothermal energy is managed by leases issued by the BLM. The planning area contains four USGS known geothermal resource areas: West Fork, Pagosa Ranger District (approximately 80,577 acres); Pagosa Springs, Pagosa Ranger District (approximately 26,300 acres); Dunton-Rico, Dolores Ranger District (approximately 132,109 acres); and Trimble-Pinkerton, Columbine Ranger District (130, 313 acres).

Biomass

Biomass is organic matter available on a renewable basis (including forest and mill residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residues, aquatic plants, fast-growing trees and plants, and municipal and industrial wastes). Forest products for fuels treatment products are available for potential development. However, no current demand exists, and none is expected in the foreseeable future. With significant agricultural operations, Colorado is a good candidate for increased use of biomass fuels, especially those that do not require large amounts of water. Electricity generation potential in Colorado from biomass materials is approximately 4 million megawatt-hours per year.

Proposals for the development of biomass generation would comply with timber harvesting and fuels treatment standards when the sources of fuel are removed from public lands. A separate site-specific environmental analysis would be required for such a proposed harvest of biomass fuel.

Wind

Areas of Class 3 (medium resource level) or higher wind resource can be found throughout the southern Rocky Mountain region. The most extensive area of wind resource is found over the high plains and uplands of eastern Colorado and eastern New Mexico. Over this area, the annual average wind resource level is mostly Class 3 and Class 4, but can be higher on exposed hilltops that are found over portions of the High Plains region. Mountain summits and ridge crests estimated to have Class 3 or higher wind resources exist throughout the southern Rocky Mountain region. Higher mountain ranges are estimated to have at least Class 6 (high wind resource level), but many of these ranges may not be suitable, due to the ruggedness of the terrain and the potential for extreme wind and icing conditions. Electricity generation potential in Colorado from wind generation is approximately 601 million megawatt-hours per year.

High potential wind energy sites within the planning area are identified on high alpine ridges in the San Juan Mountains. Wind energy development on BLM-administered lands near Durango (identified as having medium to high resource levels) were not considered to have development potential in the FEIS on Wind Energy Development completed by the BLM in 2005 (BLM 2005d). A site-specific environmental analysis would be required in order to address maintenance of a high visual quality standard before wind power would be permitted within the planning area.

Solar

Colorado has more than 300 days of sunshine per year, making it an ideal location for solar photovoltaics and solar thermal technologies. Nearly 30 schools are tapping into the power of the sun, thanks to customers of Xcel Energy who round their bills up to a higher dollar amount and/or contribute to the Renewable Energy Trust Program. Electricity generation potential in Colorado from solar power is approximately 83 million megawatt-hours per year.

No potential has been identified for the development of commercial solar energy generation on public lands in southwest Colorado. Localized use of solar generators for other uses may occur and would be addressed in site-specific environmental analysis.

3.21.3 Environmental Consequences

Direct and Indirect Impacts

With no to very low potential for commercial geothermal development, wind, or solar power generation on public lands in the planning area, the environmental consequences described in this section only analyze biomass as a potential energy source. Facility construction and operation for biomass energy generation sites would be the same as the construction and use of other facilities, and would require a specific area to be dedicated to a primary use and, secondarily, to other compatible uses.

General Impacts

Potential biomass generation facilities would be located near communities and existing infrastructure. They would rely on existing transportation facilities for moving materials to a centralized generation plant. Standards and guidelines would be the same under all of the alternatives, and restrictions on development would be implemented in order to ensure compliance with laws and regulations governing development projects. The impacts related to the cost of production, availability of forest products, and access to markets may influence the development of biomass as an energy source. Alternatives B and C, which would propose less available land for development, would be the most restrictive. These alternatives would generally prohibit the development of permanent industrial facilities or would require limits or prohibitions on road access, as well as lower levels of materials available for biomass energy generation. Some site-specific closures or restrictions on alternative energy development may occur. Certain less-developed areas may impose high site-specific costs. However, given the minimal expected level of alternative energy development expected during the life of the LRMP, there may be no reasonably measurable differences between the alternatives.

Impacts Related to Wildlife and Fisheries Management

Wildlife management activities that may result in impacts to alternative energy development are primarily related to management requirements under the ESA, as well as access to resources. Protective measures applied to construction and operations may increase costs. Conservation strategies, critical habitat designations, and BOs would address specific management requirements for all energy development within the planning area and would be the same under all of the alternatives.

The impacts related to wildlife and fisheries management on alternative energy development may be similar under all of the alternatives. Differences in the potential impacts on habitat designations, standards and guidelines, and habitat improvement treatments may result in negligible impacts to the development of biomass energy production. Vegetation from habitat treatments may be a viable source for biomass generation facilities under all of the alternatives.

Impacts Related to Travel Management and Recreation

Within the planning area, public roads would be used to gain access to materials, sight generation plants, and transport energy to markets in order to develop potential biomass energy resources. Limiting the use of existing roads and trails by timing and/or by vehicle type would restrict general or

casual access for moving materials to a generation facility and for actual sighting of a generation plant. Limiting or foreclosing new road construction may increase costs and may preclude development activity in areas near communities.

The impacts related to travel management and recreation on alternative energy development may be similar under all of the alternatives. The impacts from restrictions on biomass harvesting and siting of production facilities may be negligible, given that the siting of facilities could occur near communities and existing road systems under all of the alternatives.

Impacts Related to Timber Harvesting, Fuels Management, and Oil and Gas Development

Biomass energy development would generally be compatible with timber harvesting, fuels management, and oil and gas development activities. Based on management direction that would encourage facility development using similar infrastructure with these facilities—which could provide a supply of material for biomass generation facilities—impacts may be minor.

The impacts related to timber harvesting, fuels management, and oil and gas development activities on alternative energy development may be similar under all of the alternatives. Based on the availability of harvested material, the sighting of production facilities, and the sharing of infrastructure, impacts may be negligible, given that the sighting of facilities could occur near communities and existing road systems under all of the alternatives.

Cumulative Impacts

Given the minimal level of current use, and the low expectations for future development, there may be no important differences in cumulative impacts to this resource under any of the alternatives. Using existing infrastructure, siting near communities, providing a market for harvested material from timber management, and using existing or proposed transportation systems may benefit the future development of biomass generation facilities within the planning area.

3.22 Wilderness and Lands with Wilderness Characteristics

3.22.1 Introduction

The SJNF shares the management on portions of three wilderness areas (Weminuche, South San Juan, and Lizard Head) with two other forests (the Grand Mesa, Uncompahgre and Gunnison National Forests [combined] and the Rio Grande National Forests). The SJNF also manages the Piedra Area, an area congressionally designated for protection of its wilderness character. The TRFO has management responsibility for eight BLM WSAs: the Dolores River Canyon, McKenna Peak, Menefee Mountain, Weber Mountain, Handies Peak, West Needles Contiguous, Whitehead Gulch, and Weminuche Contiguous. In total, the TRFO manages approximately 56,576 acres of WSAs, and the SJNF manages 420,521 acres of congressionally designated wilderness areas and the Piedra Area (approximately 62,550 acres).

Under the Colorado Wilderness Act of 1993, the Piedra Area was designated by Congress to maintain the area’s existing wilderness character. It has potential to be included in the National Wilderness Preservation System; however, under the Act's Section 9(b) Management, (2)(a), the SJNF is not obligated to study the area for official wilderness designation. Based on this

Congressional mandate, the FEIS does not include the Piedra Area in its roadless analysis. However, areas adjacent to the Piedra Area were analyzed.

Wilderness is part of the multiple-use management mission of both the BLM and the USFS. Wilderness provides opportunities for solitude, as well as for primitive and unconfined recreational experiences. Wilderness is also important to the maintenance of species diversity, the protection of threatened and endangered species, and the protection of watersheds, scientific research, and various social values. (For additional information about wilderness, WSAs, and/or other special areas, refer to Wilderness Management Direction, amending the LRMP for the San Juan and Rio Grande National Forests, which was completed in August 1998. The San Juan/San Miguel Wilderness EIS [BLM 1990b] is incorporated herein by reference.)

The Wilderness Act of 1964 directs the USFS to analyze additional undeveloped and unroaded lands for proposed inclusion in the National Wilderness Preservation System. The USFS inventories potential wilderness by identifying roadless areas of approximately 5,000 acres or larger and/or roadless areas adjacent to existing wilderness areas. There are three tests applied to roadless areas before they are considered for wilderness area recommendations: capability, availability, and need (see Volume III, Appendix C–Roadless Area Inventory and Wilderness Evaluation). See also Map 64 in Volume III, Appendix V.

On October 21, 1993, the BLM completed its formal wilderness review of the planning area. As a result of the analysis, the areas currently managed as WSAs would remain WSAs, until wilderness legislation is passed or until Congress releases the areas for multiple uses.

Inventory and Evaluation of Lands with Wilderness Characteristics

In addition to the initial wilderness review required by Section 603 of FLPMA that led to the creation of WSAs, the Secretary of the Interior is also required to "maintain on a continuing basis an inventory of all public lands and their resource and other values," which encompasses wilderness characteristics as a resource (FLPMA, Section 201).

In July 2011 the BLM Director reaffirmed this responsibility via IM 2011-154 (BLM 2011b), which directed field units to review and update their inventory of lands for their wilderness characteristics and established a uniform protocol for doing so. The same IM emphasized that such an inventory "shall not, of itself, change or prevent change of the management or use of the lands." Rather, the findings of the wilderness characteristics inventory are to be considered among all other resource values and potential resource uses during the land use planning process. IM 2011-154 became policy as BLM Manual 6310 in July 2012.

The wilderness characteristics inventory and evaluation applies only to BLM roadless lands that meet specific criteria as described in Volume III, Appendix O. Appendix O contains a detailed description of the initial geographic information system (GIS) and wilderness characteristics field analysis procedures, describes the areas inventoried, and summarizes the findings of the wilderness characteristics evaluation.

Three broad categories of management strategies are used in this FEIS to address wilderness character, and each of the three categories may consist of a variety of land use stipulations, restrictions, or other methods to account for wilderness values.

The "protect" category is used in those areas deemed most critical for protection of wilderness values. Examples of such areas include areas adjacent to existing WSAs or specially designated areas,

viewshed areas for other sensitive/protected areas, or areas that offer outstanding primitive recreational opportunities.

The “not protect” category is applied in areas that may be impractical to manage for their wilderness values due to their shape, proximity to non-compatible uses or highways, or may be already leased and have high potential for oil and gas development. Standard (or more restrictive) land use stipulations and site-specific NEPA analysis would apply in these areas regardless of whether they are managed for their wilderness characteristics or not. Potential impacts to wilderness values would be addressed and evaluated during future project-level planning and environmental analysis.

Legal and Administrative Framework

Laws

- **The Wilderness Act of 1964:** This act established a National Wilderness Preservation System for the permanent good of the whole people and other purposes. The act provides guidance for the designation and management of wilderness areas.
- **The Federal Land Policy and Management Act of 1976:** Section 603 of FLPMA instructed the BLM to inventory all of its lands, identify which were definitely not of wilderness quality, and then begin an intensive inventory and analysis to determine which of the remaining lands would be recommended for inclusion into the National Wilderness Preservation System. Section 201 of FLPMA requires the Secretary of the Interior to “prepare and maintain on a continuing basis an inventory of all public lands and their resource and other values.” This requirement includes inventory and evaluation of wilderness values and applies to all BLM lands.
- **The Colorado Wilderness Act of 1993:** This act adds acreages to the following wilderness areas: Buffalo Peaks, Byers Peak, Fossil Ridge, Greenhorn Mountain, Hunter-Fryingpan, La Garita, Lost Creek, Mount Zirkel, Never Summer, Ptarmigan Peak, Raggeds, Sangre de Cristo, Sarvis Creek, South San Juan, Uncompahgre, Vasquez Peak, and Weminuche.

Regulations and Policies

- **BLM Policy H-8550-1 (1995):** This provides direction for the roles of the states and the BLM in the management of resident fish and wildlife in WSAs; policy for construction of new permanent installations and for surface-disturbing activities in WSAs; policies related to stocking, augmentation, and re-establishment of wildlife species in WSAs; policies for introduction or transplant of wildlife species into WSAs; wildlife damage management in WSAs; and modifications to Chapter 1, Section B, on implementing specific policy guidance related to management of WSAs.
- **FSM 2300:** This provides direction for management and planning in relation to recreation, wilderness, and related resources.
- **2012 Colorado Roadless Rule:** This rule, affecting management of all NFS roadless areas within the State of Colorado, went into effect in June 2012. It specifically directs the agency how to manage roadless areas for the foreseeable future and is incorporated into this LRMP planning effort.

Management of designated wilderness and BLM WSAs is formally dictated by the Wilderness Act and the agency policies noted above. Roadless areas are now managed under the Colorado Roadless Rule of 2012, which was formally approved between the draft and final stages of this planning process.

Volume III, Appendix V, Maps 65 and 66 depict recommended wilderness areas for Alternatives B and C.

3.22.2 Affected Environment

Existing Conditions and Trends

Roadless Inventory

Using criteria from USFS directives, the SJNF conducted an inventory for this planning process identifying 20 areas (totaling approximately 558,282 acres) as having roadless character. (See Volume III, Appendix C for detailed discussions of the 20 IRAs and for details on the proposed management for each of the IRAs.) Although IRAs are now superseded by the CRAs identified in Appendix C, the IRAs remain in Appendix C for comparative purposes and because their individual evaluations form the rationale for wilderness recommendations.

IRAs included for analysis in this FEIS meet the following criteria from the Wilderness Act and from FSH 1909.12:

- areas contain 5,000 acres, or more;
- areas contain less than 5,000 acres, but are contiguous to existing wilderness areas or to areas recommended for wilderness under other federal ownerships; and
- areas do not contain classified roads.

Classified roads are those that are wholly, or partially, within or adjacent to NFS lands determined to be needed for long-term motor vehicle access. This includes private, local, state, and other federal roads (USFS [36 CFR 212.1])

Roadless areas may contain motorized and non-motorized trails and user-created roads. They may also contain improvements (including motorized trails, unauthorized user-created roads, fences, outfitter/guide camps, and evidence of historical logging activities).

Recent timber harvesting areas, utility corridors, ski areas, and large reservoirs were excluded from the inventory. Table 3.22.1 shows the 20 areas included in the roadless area inventory. The 558,282 roadless acres are approximately 29% of the total SJNF area.

Table 3.22.1: Roadless Areas Inventoried

	Area Number	Inventoried Roadless Area	Acres	Landscape
1	SJ240	San Miguel	64,162	Columbine and Dolores
2	SJ284	South San Juan Adjacent	35,077	Pagosa
3	SJ285	Treasure Mountain	22,512	Pagosa
4	SJ286	Turkey Creek	25,326	Pagosa
5	SJ291	Graham Park	17,808	Columbine
6	SJ292	Piedra Area Adjacent	44,789	Columbine and Pagosa
7	SJ293	Runlett Park	5,618	Columbine
8	SJ294	Florida River	5,726	Columbine
9	SJ295	HD Mountains	25,140	Columbine
10	SJ302	East Animas	16,864	Columbine
11	SJ303	West Needles	7,049	Columbine
12	SJ304	Blackhawk Mountain	17,533	Dolores
13	SJ305	Storm Peak	57,623	Dolores
14	SJ306	Hermosa	148,139	Columbine and Dolores
15	SJ315	Ryman	8,665	Dolores

	Area Number	Inventoried Roadless Area	Acres	Landscape
16	SJ310	Fish Creek	13,537	Dolores
17	SJ320	Weminuche Adjacent	22,683	Columbine and Pagosa
18	SJ235	Lizard Head Adjacent	5,558	Dolores
19	SJ309	Baldy	20,032	Dolores
		Total	558,282	

Wilderness Potential Evaluation

Lands evaluated under the roadless inventory were further evaluated for their potential as wilderness areas. This evaluation is based on wilderness capability, availability, and need.

Capability: The capability of a potential wilderness area is the degree to which that area contains the basic characteristics that make it suitable for wilderness. The characteristics considered in this analysis are shown in Table 3.22.2.

Table 3.22.2: Wilderness Characteristics

Environment	The degree to which an area appears to be free from disturbance, so that the normal biological processes continue; and the degree to which the area provides visitor opportunity for solitude and sense of remoteness.
Challenge	The degree to which the area offers visitors an opportunity to experience adventure and self-reliance, often measured by the physical character of the land (terrain and vegetation) and proximity to sights and sounds of developments and travel systems.
Manageability of boundaries	Consideration of the ability to manage the area as wilderness; factors considered are size, shape, and juxtaposition to external influences.
Special features	The capability of an area to provide other features such as geologic, scenic, or cultural values.

Availability: The availability of a potential wilderness area is conditioned by the value of the wilderness resource, when compared to the value of, and need for, other resources. Examples of values that may conflict with wilderness values include oil and gas potential and exploration, timber harvesting, motorized travel and mechanical transport (summer or winter), fuels reduction needs, wildlife habitat treatments, and/or water storage needs. All lands identified as capable are further evaluated for availability. Table 3.22.3 lists lands that have been identified as capable and available for wilderness within the planning area

Table 3.22.3: Roadless Areas Capable of and Available for Wilderness Recommendation

Roadless Area Name	Acres	Adjacent Wilderness	Availability	Capability
Baldy	20,343	Weminuche	Available	Capable
Blackhawk Mountain	17,533	Lizard Head	Available	Capable
East Animas	16,854	Weminuche	Available	Capable
Fish Creek	13,533	Lizard Head	Available	Capable
Florida River	5,720	Weminuche	Available	Capable
Graham Park	17,808	Weminuche	Available	Capable
HD Mountain	25,044	Piedra	Not available	Not Capable
Hermosa	148,103	Lizard Head, Weminuche	Available	Capable
Lizard Head Adjacent	5,805	Lizard Head	Available	Capable
Piedra Area Adjacent	40,841	Piedra	Available	Capable
Runlett Park	5,615	Weminuche	Available	Capable
Ryman	8,665	Lizard Head	Available	Capable
San Miguel	64,263	Lizard Head,	Available	Capable

Roadless Area Name	Acres	Adjacent Wilderness	Availability	Capability
		Weminuche		
South San Juan Adjacent	34,899	South San Juan	Available	Capable
Storm Peak	57,617	Lizard Head	Available	Capable
Treasure Mountain	22,500	South San Juan	Available	Capable
Turkey Creek	25,300	Weminuche	Available	Capable
Weminuche Adjacent	22,614	Weminuche	Available	Capable
West Needle	6,881	Weminuche	Available	Capable
Winter Hills/Serviceberry Mountain	5,115	South San Juan	Available	Capable

Need: In terms of wilderness potential, need addresses the degree to which an area would contribute to the overall National Wilderness Preservation System. Need is evaluated on a regional basis and takes into consideration such factors as geographic distribution and representations of landforms and ecosystems. Table 3.22.4 summarizes the need evaluation for potential areas within the planning area.

Table 3.22.4: Need Evaluation for Potential Wilderness Areas

	Area No.	Roadless Area Name	Acres Needed	Need
1	SJ310	Fish Creek	0	The area would not add significantly to the National Wilderness Preservation System. Proposed management under all alternatives would protect wilderness characteristics while, at the same time, allowing for additional management tools not allowed under wilderness protection. Recreation use (including mechanical transport) would be allowed while, at the same time, maintaining the character of the area.
2	SJ305	Storm Peak	0	Same as Number 1.
3	SJ315	Ryman	0	Same as Number 1.
4	SJ235	Lizard Head Adjacent	2,632	The area would enhance wilderness management of the existing Lizard Head wilderness area by improving the boundary.
5	SJ304	Blackhawk Mountain	0	Same as Number 1.
6	SJ306	Hermosa	50,895	The area would enhance the National Wilderness Preservation System by incorporating the west side of the Hermosa drainage, from the lower-elevation ponderosa pine to the top of Hesperus Mountain.
7	SJ240	San Miguel	0	Same as Number 1
8	SJ303	West Needle	0	Same as Number 1.
9	SJ302	East Animas	0	Same as Number 1.
10	SJ309	Baldy	0	Same as Number 1.
11	SJ294	Florida River	0	Same as Number 1.
12	SJ293	Runlett Park	0	Same as Number 1.
14	SJ 292	Piedra Area Adjacent	0	Same as Number 1.
15	SJ291	Graham Park	0	Same as Number 1.
16	SJ320	Weminuche Adjacent	1,428	The area would enhance wilderness management of the existing Weminuche wilderness area by improving the boundary.
17	SJ286	Turkey Creek	578	The area would enhance wilderness management of the existing Weminuche wilderness Area by improving the boundary.
18	SJ285	Treasure Mountain	0	The area would not add significantly to the National Wilderness Preservation System. Proposed management under all of the alternatives would protect wilderness characteristics while, at the same time, allowing for additional management tools not allowed under wilderness

	Area No.	Roadless Area Name	Acres Needed	Need
				protection. Recreation use (including mechanical transport) would be allowed while, at the same time, maintaining the character of the area.
19	SJ284	South San Juan Adjacent	0	Same as Number 18.

Inventory and Evaluation of Lands with Wilderness Characteristics

<u>Existing Conditions and Trends</u>

Twenty land units totaling 107,518 acres were identified for further wilderness characteristics analysis during a preliminary GIS analysis. Of the 20 units, seven units totaling 40,532 acres were found to have wilderness characteristics after research and field evaluations (see Volume III, Appendix V, Maps 67 and 68 for a geographic representation of lands managed for wilderness charateristics for each alternative). These seven units were carried forward into the LRMP and FEIS, and their wilderness characteristics are considered among other resource values as directed in IM 2011-154 (BLM 2011b). A full discussion of the analysis methodology and a description of each analysis unit are included in Volume III, Appendix O.

The BLM received input through a document titled *A Citizen's Wilderness Proposal* (San Juan Citizen's Alliance 2005) as part of the planning process, and this proposal and later iterations have been useful in guiding the wilderness characteristics evaluation process. The information contained in the proposal was considered during the development of various management strategies for wilderness characteristics and was also useful in formulating other broad-scale management recommendations.

Table 3.22.5 presents a summary of lands that were found to contain wilderness characteristics during the wilderness characteristics inventory and analysis. The various units are assigned appropriate management strategies per alternative and the acreage under each strategy is summarized per alternative for comparative purposes.

Table 3.22.5: Lands with Wilderness Characteristics and Management per Alternative (Bureau of Land Management)

Unit Summary			Acres Managed for Wilderness Characteristics per Alternative			
Area Number	**General Location**	**Acres**	**A**	**B**	**C**	**D**
CO-030-251-a	North Menefee Mtn.	1,157	N/A	0	1,157	0
CO-030-286-b	McKenna Peak	2,635	N/A	0	2,635	0
CO-030-286-d	McKenna Peak	2,385	N/A	0	2,453	0
CO-030-286-f	McKenna Peak	1,578	N/A	0	2,052	0
CO-030-301a	Snaggletooth (west)	10,144	N/A	0	9,213	0
CO-030-301b	Snaggletooth (east)	19,518	N/A	10,723	17,920	0
CO-030-290-h	Coyote Wash	3,115	N/A	1,144	1,144	0
Total acres		**40,532**		**11,867**	**36,574**	**0**

3.22.3 Environmental Consequences

Direct and Indirect Impacts

General Impacts

Areas Recommended for Wilderness: Under Alternative B, approximately 54,886 roadless acres would be recommended for wilderness. Under Alternative C, approximately 535,269 roadless acres would be recommended for wilderness. Alternatives A and D would not propose any areas for wilderness. A recommended wilderness determination, however, would not create a wilderness area; Congress must pass legislation designating areas as wilderness. All of the areas recommended for wilderness would be under an MA 1 allocation, which would protect the characteristics that make the area suitable for wilderness designation.

The areas recommended for wilderness were identified using indications of public support, as well as information and data regarding the area's representation of special features (including large areas or topography that provides opportunities for solitude and primitive recreation; underrepresented geology and landforms, especially sedimentary geology and canyons; boundaries contiguous with existing wilderness areas; or areas recommended for wilderness under other federal ownership). The presence of wildlife species (including Canada lynx, Colorado cutthroat trout, water vole, sage-grouse, and/or pine marten), as well as records of bighorn sheep sightings, were considered. Sensitive plants, rare taxa, and their representative vegetation communities were also considered. The presence of cover types underrepresented in existing wilderness areas was identified as special features (including grasses, sagebrush, aspen, cottonwood/willow, Douglas-fir, limber pine, ponderosa pine, and pinyon-juniper). (See Volume III, Appendix C, for additional documentation of the special features of each area.)

The areas recommended for wilderness are typically somewhat smaller than the inventory areas. However, under Alternative C, all of the roadless areas (except for the HD Mountains) would be recommended for designation as a wilderness area, a WSR, or an RNA. The HD Mountains roadless area would not be available for wilderness because 88% of the area is leased for oil and gas development.

Lands with Wilderness Characteristics (Bureau of Land Management)

The alternatives present a range of options with regards to lands to be managed for their wilderness characteristics as shown in Table 3.22.5 above. When compared to Alternatives A and D, Alternatives B and C both offer greater protection for the wilderness characteristics in these areas. Alternative C protects all seven units and 36,574 acres, with Alternative B protecting 2 units and 11,867 acres. Thus, Alternative C offers the greatest degree of protection for wilderness characteristics and Alternative B to a lesser degree. Both Alternatives A and D offer no specific protection for wilderness characteristics in the seven units, although future project-level NEPA analyses would address impacts to wilderness character among other resources.

In general, the configuration, size, and presence of other compatible resource values within lands managed for their wilderness characteristics in Alternative B lend themselves to management for these values. In addition, lands to be managed for their wilderness characteristics were evaluated as to existing oil and gas leases and other potentially conflicting resource allocation decisions within the LRMP prior to deciding upon each alternative management strategy.

Protective measures for lands with wilderness charcteristics are not prescribed or required by agency policy, which states that wilderness characteristics must be considered along with the other resource values associated with the inventory areas. However, adverse impacts to wilderness values identified via subsequent project-level NEPA analysis within lands with wilderness characteristics would be closely scrutinized. In any case, wilderness characteristics identified through the wilderness characteristics inventory process would be duly considered along with other resources and values during subsequent project-specific NEPA analysis.

Impacts Related to Management Area Allocations

Table 3.22.6 shows the distribution of roadless acres inventoried across the range of MAs by alternative. Alternative C has the highest acreage in MAs 1–3, with Alternatives B, A, and D with less, respectively. In general, MAs 1–3 offer the greatest degree of protection for currently undeveloped "core" areas.

Table 3.22.6: Roadless Acres in Management Areas by Alternative

Management Area	Alternative A	Alternative B	Alternative C	Alternative D
1	1,803	113,286	528,173	16,321
2	522	41,601	29,417	28,879
3	384,379	371,014	1	418,754
4	45,381	25,312	183	27,109
5	119,107	464	508	55,657
7	0	4,181	0	4,196
8	7,090	2,423	0	7,366

The highest degree of protection of lands from development is found in Alternative C, with a lesser degree in Alternative B. Alternative D has the least degree of protection for lands from development actions. Under all alternatives CRAs would be managed under the direction of the 2012 Colorado Roadless Rule which prescribed prohibited activities and situations by which exceptions to prohibitions are permissible.

Impacts Related to Livestock Grazing

The Wilderness Act (Section 4(d)(4)) allows livestock grazing "where established prior to the effective date of this Act…subject to such reasonable regulations as are deemed necessary." Permitted grazing would continue in roadless areas, and there would be a minor increase in grazing. The impacts related to livestock grazing on wilderness and roadless areas may be similar under all of the alternatives.

For BLM lands managed for wilderness characteristics, the potential for short-term grazing related impacts exists in areas already under active grazing allotments, but where current allotment management stipulations do not account for protection of wilderness character. Any new grazing leases, or reauthorization or changes to existing leases, would be analyzed in site-specific NEPA, and protecting wilderness character would be necessary when designing stipulations, season of use, water developments, etc. New grazing developments under Alternatives B and C could impact wilderness character and would be subject to any mitigation measures identified within site-specific NEPA analysis. Although impacts could be reduced from protective measures (see LRMP Section 3.8), they may not be eliminated entirely if new projects are implemented. Under Alternatives A and D, wilderness characteristics on all 40,532 acres where they were found on the TRFO would be

subject to impacts from livestock grazing because no protection of wilderness characteristics is proposed in either of these alternatives.

Impacts Related to Recreation Management

Areas recommended for wilderness would be managed in the same manner as lands currently designated as wilderness. Opportunities for primitive and non-motorized recreation would be emphasized in roadless areas recommended for wilderness designation. This is because these areas would provide the best opportunities for solitude, as well as exhibit the absence of motorized vehicles, vehicles used for mechanical transport, and the absence of human developments. Alternative B and C would provide areas managed and recommended for wilderness; Alternative A and D would not.

Roadless areas that are assigned to other MAs would be managed for the recreation opportunities available under those MAs. Generally, the existing settings are remote and semi-primitive (ROS) in character, although motorized trails occur in some areas. Snowmobiles traveling over snow (on trails or cross-country) would occur in some roadless areas. The alternatives, ranked from proposing the largest to least amount of acres with remote, semi-primitive (ROS) settings are Alternatives C, B, A, and D.

Alternative C may result in greatest beneficial impacts to wilderness and roadless areas, followed by Alternatives B, A, and D. This would be mainly due to MA designations that would retain and protect remote, semi-primitive (ROS) non-motorized settings.

Impacts Related to Timber Management

Roadless areas that allocated to MA 1 (recommended wilderness) would not be available for timber harvesting. Roadless areas allocated to MAs other than recommended wilderness are to be managed under the Colorado Roadless Rule and are subject to the prohibitions and exceptions under standard and upper tier designations.

Alternatives D and A may result in impacts to portions of some roadless areas as a result of timber harvesting. Those impacts may be minor as such projects would be subject to Colorado Roadless Rule prohibitions and exceptions. Alternatives B and C may result in the least impacts to roadless areas because timber harvesting would generally not be allowed.

Impacts Related to Travel Management

Depending on travel suitability and MA allocations, roadless areas may provide a variety of travel opportunities. Roadless areas recommended for wilderness would permit foot and horse travel, and would prohibit motorized travel and mechanical transport. Other MA designations would allow for some motorized recreation and use of vehicles for mechanical transport. The impacts to roadless areas related to travel management may be the same as the impacts related to recreation management.

Overall, travel management designations under Alternative C may result in the greatest beneficial impacts to wilderness and roadless areas, followed by Alternatives B, A, and D, because they would retain and protect remote, semi-primitive (ROS) non-motorized settings.

Lands managed to protect wilderness characteristics in Alternatives B and C are closed to motorized travel, which would promote naturalness and opportunities for primitive recreation. Under Alternative D, naturalness and opportunities for primitive recreation across the 40,532 acres found to have wilderness character would be promoted to a lesser extent than Alternatives B and C and possibly

diminished due to these areas being open to motorized travel on designated routes. Under Alternative A, areas with wilderness characteristics would still be open to cross-country motorized travel, which could cause wilderness character to be diminished or eliminated in these areas.

Impacts Related to Special Area Designations

Under all of the alternatives, RNA proposals (MA 2) and WSR recommendations would overlap portions of the wilderness and roadless areas and, therefore, may result in no impacts to the capability or need for wilderness recommendation. This is because their management would be compatible with the management of wilderness areas, WSAs, and proposed wilderness areas. RNA and WSR designations would protect wilderness values, even if the areas were managed for other purposes. The impacts related to special area designations would be the same under all of the alternatives.

Impacts Related to Fire and Fuels Management

Under MA 1s, earth-moving equipment would not be used in order to manage wildfire. Wildfire for ecological benefit may occur under MAs 1, 2, and 3, if site-specific fire management planning is completed. Fuels treatment would be allowed under MAs 1, 2, and 3, when it is compatible with wilderness values and the Colorado Roadless Rule. Impacts from fire and fuels management may be mitigated by policy and process, and may result in impacts to roadless area qualities. The impacts related to fire and fuels management may be the same under all of the alternatives.

On BLM lands managed for wilderness characteristics, use of motorized heavy equipment such as dozers would be limited and/or rehabilitation would be required after active suppression using such tools because permanent impacts to wilderness character would not be allowed in those areas. Active fuels reduction projects would also be required to mitigate any long-term impacts to wilderness character. Fire and fuels management activities could diminish wilderness charateristics under Alternatives A and D as these alternatives offer no protection of wilderness characteristics from these activities. However, impacts to existing wilderness characteristics would need to be considered during project level analysis.

Impacts Related to Oil, Gas, and Minerals Development

Roadless areas under MA 1 would be administratively unavailable for oil, gas, and mineral development; therefore, they would be largely unaffected by development. Management of NFS roadless areas is now directed by the 2012 Colorado Roadless Rule, which is incorporated by reference into appropriate portions of the LRMP.

Formally designated wilderness areas and the Piedra Area are withdrawn from mineral leasing. BLM WSAs are administratively not available for mineral leasing.

Roadless areas on the SJNF have MA direction under the four alternatives that permit oil and gas leasing using an NSO stipulation, but any such development must also be consistent with the Colorado Roadless Rule. Roadless areas on the SJNF generally have no to low oil and gas resource potential. Consequently, under all of the alternatives, based on present knowledge of geology, there would be no to minor lease interest in these areas.

McKenna Peak, a BLM WSA, has moderate oil and gas resource potential and there is gas development within the area's general proximity. McKenna Peak would remain administratively not available for lease and the northern portion of the WSA has been recently nominated for wilderness

designation in the 2009 Colorado Wilderness Bill. The alternatives are similar in terms of potential for oil and gas leasing, oil and potential is low, and leases would be issued under terms of NSO.

Significant portions of BLM lands containing wilderness characteristics are currently leased for oil and gas development, and other areas are available for potential future leasing under the alternatives. A majority of the 11,867 acres to be managed for wilderness characteristics under Alternative B are already leased for oil and gas development, so impacts from potential oil and gas development would be expected, including construction of temporary roads and sights and sounds that would diminish naturalness and solitude. New areas made available for leasing within lands managed for wilderness character would be subject to surface occupancy restrictions and the other proective standards for lands with wilderness character.

Under Alternative B, 6,779 acres of the total 11,867 acres to be managed for wilderness characteristics would be available for leasing and subject to new oil and gas leasing stipulations. Lands managed for wilderness characteristics would have some degree of protection from impacts under Alternatives B, but such protections would not supersede valid rights under existing leases. Under Alternative C, lands managed for wilderness characteristics are not available for lease, so there would be no new impacts frm oil and gas leasing and development under Alternative C. Oil and gas leasing and development in Alternatives A and D could heavily impact a large portion of the 40,532 acres of wilderness characteristics found throughout the TRFO as these areas areas are generally high to moderate in oil and has potential and Alternatives A and D offer no protective stipulations or mitigation measures for wilderness characteristics. However, impacts to these resource would be considered during subsequent analysis, prior to oil and gas development activity.

Mineral sales and extractive commercial uses would not impact wilderness characteristics as those activities would not be allowed within lands managed for wilderness characteristics.

Cumulative Impacts

Roadless area characteristics are changed as the result of many types of development (including roads, timber management, recreation facilities, and reservoirs). Although the total acres developed in the past planning period was relatively small, the decrease in acres with roadless characteristics is a long-term and continuing trend (although perhaps not noticeable within the implementation life of the final approved LRMP). Historically, the development of roads and the management of timber stands have impacted the most acres. This trend, however, has slowed dramatically and is likely to continue to decline in the future.

Development of private in-holdings, as well as oil and gas development (especially in the HD Mountains roadless area) has been the primary reason for the loss of roadless characteristics. The impact of development extends from the past into the future and would apply to the general planning area (outside wilderness areas). The impacts may be least under Alternative B and C (where areas are recommended for wilderness designation), and the greatest under Alternatives A and D. Under a no leasing scenario, all of the roadless areas except for the HD Mountain's and 974 acres of the South San Juan Adjacent IRA would not have any potential for oil and gas exploration.

OHV use (including jeeps, sport utility vehicles, ATVs, mountain bikes, motorcycles, and other vehicles) has increased within the planning area. A motorized rider or one traveling by mechanical transport can travel across larger areas in a shorter amount of time than most other recreation users; therefore, the demand for access to more terrain is likely to increase. Advocates for OHV use are expected to request increased access to roadless areas over the life of the LRMP.

Unauthorized motorized routes, both roads and trails, have been created and/or extended within the planning area. The lack of adequate well-maintained signs contributes to this problem. Use of unauthorized routes has occurred in both roaded and unroaded parts of the planning area. If this use continues, it may diminish roadless area values. As local and national populations continue to age, the demand for easier access, primarily vehicle access, to destinations with roadless areas is expected to increase. The current impacts related to user-created routes are widespread within the planning area. User-created routes, however, are expected to decline in the future as a result of the elimination of areas open to cross-country use under all of the alternatives and as a result of the restoration of existing user-created routes. The impacts related to user-created routes are expected to decline in the future under Alternative C (as a result of prohibiting motorized use in areas recommended for wilderness area designation). Currently, instances of unauthorized use are managed through peer pressure and law enforcement. The implementation of the 2005 Travel Management Rule may move the trend away from unauthorized use.

Roadless areas may be impacted by development activities that are permissible under the Colorado Roadless Rule and motorized recreation.

3.23 Wild and Scenic Rivers

3.23.1 Introduction

The WSRA was enacted by Congress in order to preserve select rivers in a free-flowing condition and to protect other river-related values. As of 2013, segments of 203 rivers totaling 12,602 miles were designated as a component of the National Wild and Scenic Rivers System (wild rivers [6,168 miles], scenic rivers [2,722 miles], and recreational rivers [3,712 miles]). These nationally recognized rivers make up a valuable network of natural and cultural values. In total, WSR designations have been made on slightly more than 0.25% of the nation’s rivers.

The WSRA requires the Secretary of the Interior and the Secretary of Agriculture to undertake studies and investigations to determine which additional wild, scenic, and recreational rivers must be evaluated through land use planning. To be eligible, a river must be free-flowing and must possess one or more ORVs. To be suitable, a decision is made that the identified values should be protected and that adding the river to the national system is the best method for protecting identified values.

Legal and Administrative Framework

The WSRA of 1968, as amended, states:

> It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dams and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.

The WSRA establishes a method for providing federal protection for the nation’s remaining free-flowing rivers, preserving them and their immediate environments. Rivers are included in the system

so that they may benefit from the protective management and control of development for which the act provides.

The USDA/USDI Guidelines for Eligibility, Classification, and Management of River Areas (USFS and BLM 1982) supplements the WSRA. These guidelines provide uniform direction for evaluation, classification, and management of rivers for congressionally mandated studies under Section (5) of the WSRA and for other agency studies.

FSH 1909.12 Chapter 80 describes the process for identifying and evaluating potential additions to the Wild and Scenic Rivers System on NFS lands and the interim management of identified rivers.

BLM Manual 6400 describes the process for identifying and evaluating potential additions to the Wild and Scenic Rivers System on BLM lands and the interim management of identified rivers.

Protective measures for WSR corridors established by agency guidance referenced above takes precedence over land use decisions and guidance in the LRMP.

The Interagency Wild and Scenic River Coordinating Council (see: National Wild and Scenic Rivers System 2013) also guides the work of agencies in studying potential WSR and managing designated rivers as part of the National Wild and Scenic River System.

The Responsible Official may authorize site-specific projects and activities on NFS and BLM lands within river corridors that are eligible or suitable. This direction is more fully articulated in interim management guidelines found at FSM 1909.12, Chapter 80, and BLM Manual 6400, Sections 3.5 and 3.6. The interim management guidelines for both agencies provide for continued use of the rivers and surrounding lands, including certain mineral development, water development, road and trail construction, ROWs or easements for utilities, recreational developments, motorized travel, fish and wildlife management projects, vegetation management including weed control, and livestock grazing. These uses, however, must be managed, designed, or regulated to protect the free-flowing character, water quality, ORVs, and recommended classification. Agency guidance further states that BLM RMPs and USFS LRMPs should provide management direction for the river corridors to 1) ensure that Authorized Officers consider interim management guidelines when implementing the plan through authorizing projects and activities, and 2) identify the desired conditions, objectives, and suitability of areas to be used in the design of projects and activities.

Agency guidance provides for the interim protection of all stream segments identified as eligible or determined to be suitable. The USFS and BLM manuals provide for the interim protection necessary to maintain a study river as a potential WSR to be modified or discontinued for identified rivers upon a finding of ineligibility or unsuitability. Where agency plan decisions make determinations of suitability, study stream segments not carried forward as “suitable” are properly removed from interim protection under the WSRA guidance and would be managed according to the respective land use plan guidance for the area. The results of the comprehensive inventory of eligibility and determinations of suitability for the planning area are presented in Volume III, Appendix D and would be retained for future planning purposes.

3.23.2 Affected Environment

Existing Conditions and Trends

With the passage of the WSRA in 1968, Congress directed the USDA and the USDI to prepare studies of selected rivers on the national forests and public lands as potential additions to the Wild

and Scenic Rivers System. Suitability studies were prepared for the Los Pinos, Piedra, and Dolores Rivers. WSR study reports and EISs were completed for these three rivers and were submitted to Congress with recommendations for designation for most river segments. All of these studies were completed in partnership with the Colorado Department of Natural Resources. These three rivers were also re-evaluated as part of the development of this LRMP/FEIS.

- **The Dolores River:** A total of 105 miles of river was recommended for WSR designation in 1977. Of the 105 miles, 33 miles were recommended as wild, 41 miles were recommended as scenic, and 31 miles were recommended as recreational (Colorado Department of Natural Resources et al. 1976). In 1989, the USFS re-evaluated the WSR eligibility and classification recommendations for the Dolores River. Changes to the management of public lands occurred between the 1976 and 1989 studies. Of the original 105 miles of recommended river, 94 miles of river on the SJNF were transferred to the BLM. The remaining 9 river miles on the SJNF were again recommended as eligible with a recreation river classification in 1989.
- **The Piedra River:** A total of 50.9 miles of the river was recommended for designation. Of the 50.9 miles, 32.5 miles were recommended as wild, 12.9 miles were recommended as scenic, and 5.5 miles were recommended as recreational (USFS et al. 1979). The WSR eligibility and classification recommendations for the Piedra River were re-evaluated in 1989. No changes to the original 1979 study findings were recommended.
- **The Los Pinos River:** A total of 20 miles of the Los Pinos, as well as 34 miles of its tributary streams, was recommended for designation. All 54 miles of river segments were recommended as wild. The recommended tributaries were Lake Creek, Flint Creek, Rincon La Osa, Rincon La Vaca, Snowslide Canyon Creek, and Sierra Vandera. The WSR eligibility and classification recommendations for the Los Pinos River were re-evaluated in 1989. No changes to the original 1979 study findings were recommended.

In addition to the rivers Congress authorized for study, other rivers within the planning area were also suggested for study. The Heritage Conservation and Recreation Service conducted a nationwide inventory of study river candidates for the Wild and Scenic Rivers System. This list is now managed by the NPS. In addition to the three congressionally designated study rivers, the Animas River and the San Juan Rivers (including the East and West Forks) were included on the list.

- **The Animas River:** This river was determined to not be eligible for inclusion in the Wild and Scenic Rivers System (USFS 1983). Although free-flowing, the 1983 study determined that the Animas River was highly modified in places and did not meet state water quality standards in any study segment. Most water quality impacts were attributable to historic mining in headwaters areas.
- **The San Juan River:** The mainstem San Juan and the East Fork San Juan rivers were determined to not be free-flowing. Although no impoundments occur on these rivers, channel alterations on parts of the East Fork and mainstem San Juan River were considered a disqualification for the free-flowing characteristics required by the WSRA (USFS 1983). No ORVs were found on the West Fork San Juan River.

Wild and Scenic River Evaluation Process

The WSR study process used in this analysis follows the guidance in the above documents. This guidance requires that determinations be made regarding all planning area rivers with regard to eligibility and classification, and recommends an analysis of suitability during land management planning. The list of all rivers analyzed is found at the end of Volume III, Appendix D. Eligibility and classification represent an inventory of existing conditions. Eligibility is an evaluation of whether a

river is free-flowing (without major dams, diversions, or channel modifications) and possesses one or more ORV. These values may include scenery, recreational, geological, fish, wildlife, prehistory, history, and/or other values. These values should be a unique or exceptional representation for the area studied and must be related to the river. The results of the eligibility analysis are below.

If found eligible, a river is analyzed as to its current level of development (water resources projects, shoreline development, and accessibility), and a recommendation is made that it be placed into one or more of three classes: wild, scenic, or recreational. The results of this classification are found for each eligible river in Volume III, Appendix D.

- **Wild rivers:** Wild rivers are those rivers, or sections of rivers, that are free of impoundments and generally inaccessible except by trail with watersheds or shorelines essentially primitive and waters unpolluted.
- **Scenic rivers:** Scenic rivers are those rivers, or sections of rivers, that are free of impoundments with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational rivers:** Recreational rivers are those rivers, or sections of rivers, that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

The final step in this analysis process is to evaluate eligible rivers for suitability. This step includes a discussion of the consequences of designating or not designating the river as a component of the national system (in terms of social and economic values, impacts to other resources, and other uses of the area). A suitability analysis is designed to answer the following questions:

- Should the river's free-flowing character, water quality, and ORVs be protected, or are one or more other uses important enough to warrant doing otherwise?
- Would the river's free-flowing character, water quality, and ORVs be protected through designation?
- Is it the best method for protecting the river corridor?
- Is there a demonstrated commitment to protect the river by any non-federal entities that may be partially responsible for implementing protective management?

In answering these questions, the benefits and impacts of WSR designation must be evaluated and alternative protection methods considered.

Rivers are added to the national system by an act of Congress or by the Secretary of the Interior by designation. Secretarial designation requires that a river be a part of a state river protection system and that the State Governor submit an application to the Secretary. A recommendation by the USFS or BLM for any particular river, or river segment, does not guarantee that Congress would proceed with the recommendation and designate a river to be part of the national system.

Since the passage of the WSRA in 1968, only one river in Colorado has been designated a WSR. There is increasing interest locally in both the development and the protection of rivers.

3.23.3 Environmental Consequences

Direct and Indirect Impacts

General Impacts

The miles of river with preliminary findings of suitability by alternative are displayed in Section 2.4. Only the previously studied and recommended rivers are found suitable in Alternative A. Alternative C finds all river segments identified as eligible through the inventory process for this planning effort and FEIS to also be suitable. Alternative D shows none of the rivers to be found suitable. Alternative B finds about two-thirds of river miles to be suitable. Potential impacts related to all other activities on WSR would be proportional to the number of miles of river found preliminarily suitable, as the suitable river corridors have higher standards for protection and less tolerance for development activities. Conversely, if designated as WSRs by Congress or the Secretary of the Interior, positive impacts upon river resources would result due to the higher level of protection afforded them under the WSRA. Interim management, as articulated in FSM 1909.12, Chapter 80, and BLM Manual 6400, Sections 3.5 and 3.6, show how the ORVs and classification would be protected on rivers found suitable. An analysis of potential for conflict of WSR with other resource management is found in Volume III, Appendix D. The ORVs of each segment are listed in Table 3.23.1.

Alternative C would result in the most potential protection to rivers under the WSRA, followed by Alternatives B and A, respectively. This comparison is based directly on miles of river found to be suitable. Alternative D would result in no additional river corridor protection, although standard BMPs regarding riparian corridors and water resource protection would still apply to any projects within those zones.

Table 3.23.1: Stream Segments with Outstandingly Remarkable Values

Stream Name	Fish ORV	Wildlife ORV	Recreation ORV	Geology ORV	Scenery ORV	Ecological (plants) ORV	Archaeology ORV
Dolores above McPhee	–	–	San Juan Skyway	–	–	–	–
Dolores McPhee to Bedrock*	Roundtail chub, flannelmouth sucker, bluehead sucker	Canyon treefrog	Boating	Cliffs, linear canyons	Cliffs, canyons, groves	New Mexico privet, Eastwood's monkey flower	Archeology
Rio Lado	High-purity cutthroat	–	–	–	–	–	–
West Dolores	–	Black swift nesting colonies	–	–	–	–	–
McIntyre Canyon	–	–	–	–	–	Eastwood's monkey flower	–
Bull Canyon	–	–	WSA, hiking to pools	–	–	–	–

Stream Name	Fish ORV	Wildlife ORV	Recreation ORV	Geology ORV	Scenery ORV	Ecological (plants) ORV	Archaeology ORV
Coyote Wash	–	–	WSA, hiking sandy wash	–	–	Kachina daisy, Eastwood’s monkey flower	–
Animas River, Baker’s Bridge to Silverton	–	–	Train, rafting/kayaking	–	Canyon, train	–	Historic sites, facilities, and railroad
Cement Creek	–	–	–	–	–	Iron fens	–
Cinnamon Creek	–	–	Alpine Loop	–	–	Altai cottongrass, thickleaf whitlowgrass	–
Maggie Gulch	–	–	–	–	–	Showy, Colorado Divide, and thickleaf whitlowgrass	–
Mineral Creek	–	–	San Juan Skyway	–	San Juan Skyway, wetland, colorful valley displaying geologic features	Chattanooga iron fen, sphagnum balticum	–
South Fork Mineral Creek	–	Black swift nesting colonies	–	–	–	Iron fen wetland	–
West Fork Animas and California Gulch	–	–	–	–	–	Altai cottongrass, clustered sedge	–
Hermosa Creek and Tributaries	High-purity cutthroat and reintro-duction habitat	–	Hermosa Trail used by outfitters, hunters, mountain bikes, and motorized vehicles	–	–	–	–
Los Pinos above Vallecito*	–	–	Heavy-use trail	–	Scenic valley	–	–

Stream Name	Fish ORV	Wildlife ORV	Recreation ORV	Geology ORV	Scenery ORV	Ecological (plants) ORV	Archaeology ORV
Los Pinos Tributaries previous recommend-ation*	–	–	–	–	Scenic valley	–	–
Vallecito Creek	–	–	Heavy-use trail, kayaking	–	Canyon, surroundings	–	–
Piedra River, Chimney Rock area to Forks*	–	–	Whitewater boating, fishing	Headwaters complex	Box canyons, hot springs	–	Prehistory
East Fork Piedra River	High-purity cutthroat	–	–	–	Waterfalls	–	–
Middle Fork Piedra River*	–	–	General recreation	General geology	General scenery	–	–
West Fork San Juan River	–	–	–	San Juan volcanic field, glaciation	–	–	–
Wolf Creek and Fall Creek	–	Black swift nesting colonies	–	–	Treasure Falls	–	–
East Fork San Juan River	–	–	–	Textbook glaciation and volcanics	–	–	Archeology

*Streams that were previously recommended for inclusion in the National Wild and Scenic Rivers System.

Impacts Related to Minerals Management Decisions

Minerals development, consistent with the required guidelines, may result in localized, decreased vegetation in the riparian corridor, and small and/or temporary increases in sedimentation. These activities are not expected to impact the ORVs. The rivers most likely to be impacted are those with high mineral potential, which include:

- Dolores River, above McPhee (near Rico)
- Dolores River, McPhee to Bedrock
- West Dolores (near Dunton)
- Summit Canyon
- Animas River Bakers Bridge to Silverton (near Elk Park and Whitehead Gulch)
- Cement Creek
- Cinnamon Creek

- Maggie Gulch
- Mineral Creek
- South Fork Mineral Creek
- West Fork Animas River in California Gulch
- The very upper portions of South Fork Hermosa and Clear Creek
- The very lowest portions of the mainstem of Hermosa Creek
- East Fork San Juan River

The impacts related to minerals management on WSRs would be similar under all of the alternatives, although Alternatives B and C have more potential for conflict. The potential conflicts under Alternatives B and C are due primarily to the 0.25-mile protected corridor associated with any WSR designations, which would make mineral extraction less economical or unviable in those zones. Access road building would also be restricted within those zones.

Impacts Related to Oil and Gas Management Decisions

A management corridor would be established for rivers found suitable for protection under the WSRA. In the PLAA, the Dolores River would be stipulated. Segments of the river would be classified as wild, scenic, or recreational, depending on the amount of development allowed. Each of the WSR river classifications requires a different level of protection from other potentially incompatible activities including oil and gas leasing and development.

<u>Lease Stipulations</u>

The lease stipulation shown in Table 3.23.2 would apply to river segments within the PLAA with a preliminary finding of WSR suitability. For segments falling within NFS lands, FSM 1909.12_80 states that “leases, licenses, and permits under mineral leasing laws are subject to conditions necessary to protect the values of the river corridor in the event it is subsequently included in the National System.” Oil and gas development with surface occupancy is considered not compatible with the purpose and status of those areas. Development classifications of wild and scenic require that there be no substantial evidence of human activity, so withdrawal or NSO is required. In recreational classifications there can be substantial evidence of human activity, but the physical attributes of the river corridors (e.g., Canyon walls, steep slopes, floodplains) would make surface occupancy incompatible with environmental protection requirements. Consequently, all river segments found suitable are assigned a NSO stipulation or, in the case of wild segments, are proposed for withdrawal within the alternatives.

Table 3.23.2: Surface Stipulations for Suitable River Segments per Alternative

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Dolores River Canyon	NSO	NSO	NAL	NSO
WSR	NSO	NSO	NSO	NSO

The Dolores River lease stipulation requires NSO within 0.25 mile of the canyon’s rim. This stipulation would provide additional scenic protection adjacent to the river corridor directly outside the portion recommended for wild, scenic, or recreational.

Overall, as a result of the stipulations assigned in the alternatives, oil and gas leasing and development would generally not affect the recommended river segments within their corridors.

Suitable rivers classified as wild in each alternative are administratively unavailable for oil and gas leasing, while rivers classified as scenic or recreational can be leased. Under the No Leasing Alternative, leasing would also be prohibited on suitable rivers classified as scenic or recreational. This would offer additional protection to some of the ORVs.

Impacts Related to Livestock Grazing Decisions

The continuation of livestock grazing may have little impact on WSRs. ORVs have been maintained under current grazing management, and no dramatic changes are expected if rivers are found eligible or suitable. Most WSR corridors have some acres of range allotments within them; however, standards and guidelines are in place in order to manage for desired conditions (as identified in AMPs). If new facilities are needed for livestock management, they would be designed to fit into the classification. The impacts related to livestock grazing on WSRs would be similar for all alternatives.

Impacts Related to Recreation Decisions

Current recreation management has not precluded the finding of ORVs along eligible river segments. Continued recreation at the same intensity may, therefore, have little or no impact on WSRs. As recreation increases, either due to a general increase related to population pressure or due to the findings of “suitable,” additional impacts (e.g., trash not disposed of properly and human-caused fires) may occur, but such instances are anticipated to be low. The protection of more river miles found suitable in Alternatives B and C would enhance primitive and semi-primitive recreation experiences in those areas.

Impacts Related to Vegetation Management Decisions

Timber harvest should not impact eligible rivers, since no suitable timber lands are within WSR corridors in any alternative. Vegetation management for fuels reduction may impact some segments but since those projects are allowed in WSR corridors only if they protect, enhance, or restore the river environment, impacts are expected to be low. The impacts related to vegetation management on WSRs would be similar under all of the alternatives.

Impacts Related to Water Resource Projects

A finding of suitability does not create a water right. A water resource project proposed on a suitable river would be analyzed as to its effect on a river’s free-flow, water quality, and ORVs, with adverse effects prevented to the extent of existing agency authorities (such as special use authority) and subject to valid existing rights. Projects on a suitable river may be subject to more intense analysis and additional mitigation, compared to rivers not eligible or suitable, and no approvals would be granted for storage impoundments within suitable stream segments. Many of the suitable segments would have numerous conflicts with water resources. Additional information on existing water rights, conditional water rights, and expected development on specific river segments is found in Volume III, Appendix D.

If any of the rivers found in this planning process to be suitable were to be designated a WSR by Congress or the Secretary of the Interior, a federal water right would be created. Typically, the quantification of the federal reserved right is left to the federal agency that manages the river. The agency conducts studies to determine the minimum flow rates needed to support the ORVs. Then the

federal agency submits an application containing the proposed quantification to a state court for confirmation and integration into the state water rights system. This quantity would have an appropriation date as of the date of the legislation, and would be junior to all existing water rights. Future diversions for the wild and scenic segment, or from tributaries or upstream reaches, could be challenged by the federal agency holding the water right if the proposed diversion causes flows to go below the quantified amount of the federal right. Findings of eligibility or determinations of suitability do not involve a federal reserved right.

The federal reserved right, along with all other existing water rights, could hamper water developments proposed after the WSR designation and could complicate changes in points of diversion and use of rights that are senior to the congressional designation of a WSR. The mechanism for protecting a federal reserved water right in Colorado would be through the state's water courts, following the opposition process established for all other holders of water rights in the state. The impacts related to water resources development on WSRs would correlate with the river miles found suitable as WSR. Alternatives B and C have more potential for conflict.

Maps 69 through 71 in Volume III, Appendix V, depict the wild and scenic river segments for Alternatives A, B, and C.

Cumulative Impacts

The 1983 San Juan National Forest Land and Resource Management Plan incorporated the recommendations previously made for the Dolores, Los Pinos, and Piedra Rivers, as well as the state recommendation for the West Dolores River. These rivers have been managed as suitable WSR management corridors within the planning area since that time, with their unique qualities protected by specific standards and guidelines. The BLM manages the Dolores River below McPhee Reservoir in order to protect the ORVs and has enacted a specific river management plan written specifically for the corridor. Findings of eligibility or suitability in this decision would not change the current situation substantially for these rivers previously determined to be suitable; therefore, they would not add cumulative impacts to these streams.

Findings of eligibility or suitability for the other streams listed above as eligible could have three impacts:

1. Recreation pressure may increase for the streams that have been identified as having ORVs. This is not expected to be substantial. There could be a larger increase in recreation if any of these streams are designated as WSR in the national system. Increased recreation could affect eligible WSRs (e.g., trash not disposed of properly and human-caused fires), but the effects are anticipated to be low. In a few cases, additional regulation may have to be imposed and enforced to maintain the ORVs.
2. Proposals to dam or divert these streams would be analyzed as to their effect on a river's free-flow, water quality, and ORVs, with adverse effects prevented to the extent of agency authorities. Project-level decisions are also to provide for the preservation of the tentative classification of the study segment (i.e., wild, scenic, or recreational). The result of these requirements may include longer review and processing times for proposed water developments and decisions could include requirements to modify the proposed water development or otherwise mitigate impacts to the study segment. In some cases, these reviews could result in denial of the Proposed Action. BLM Manual 6400 and FSH 1909.12 Chapter 80 provide guidance the agencies must follow in reviewing proposed water resources projects on rivers found suitable for inclusion in the National Wild and Scenic River System.

Should Congress or the Secretary of the Interior designate a stream segment as a WSR, new storage dams would be prohibited on that segment and a federal reserved water right would be established. New diversions or changes to diversions involving a state water court action might be opposed, prohibited, or otherwise affected to prevent injury to federal reserved water rights that would be established through congressional action, and to protect ORVs and river classification. As a result, the ability to obtain or modify upstream water rights could be limited to various extents, and the prohibition of new storage dams within the designated river segment could limit the amount of water that could be stored for downstream water users or require alternative approaches to providing sufficient water.

3. The cumulative impacts related to management policy and, if designated, statutory direction would be the protection of river resources and natural processes over time.

3.24 Scenic, Historic, and Backcountry Byways

3.24.1 Introduction

The planning area contains a majority of the 232-mile-long San Juan Skyway, which was designated by the USFS as a national scenic byway in 1988. In 1989, it was also designated by the State of Colorado Scenic Byway Commission as a State Scenic and Historic Byway. Both of these were the first such designations for the State of Colorado. The byway was given further distinction when it was recognized as an All-American Road. In order to receive the distinction of an All-American Road designation, the San Juan Skyway had to be considered a “destination unto itself”—a primary destination for a trip that provides an exceptional travel experience for visitors.

The San Juan Skyway also passes through the Grand Mesa, Uncompahgre, and Gunnison National Forests, as well as by Mesa Verde National Park. The San Juan Skyway links the historic towns of Durango, Silverton, Ouray, Telluride, and Cortez. This byway traverses some of the most spectacular, rugged, and primitive landscapes in America. The area is rich in cultural and historic resources from ancient Native American inhabitation (with Native Americans using and accessing the San Juan area for possibly up to 10,000 years) to the colorful mining era of the San Juan Mountains in the 1800s (including the development of the narrow-gauge railways through the area). In keeping with the primary goals of the National Scenic Byway Program, the physical development of the highway, its associated facilities, and the management of surrounding landscapes is vital to the conservation of its unique and valued attributes.

The 65-mile Alpine Loop National Backcountry Byway also passes through the San Juan Mountains (often along routes that follow ancient paths Native Americans used as they returned to their traditional summer hunting camps). The route connects the towns of Lake City, Silverton, and Ouray. Unlike scenic byways, which are located on paved roads, backcountry byways focus on out-of-the-way routes that are typically graveled. Spectacular higher-elevation scenery and numerous historical markers explain the mining history of the area as the route travels through the towering San Juan Mountains.

The Trail of the Ancients Scenic Byway highlights the long and intriguing inhabitation of the Four Corners region by Native American peoples. It escorts visitors to remote archaeologically, culturally, and historically significant sites in Colorado, Utah, and Arizona. The section of the byway within the planning area travels mainly within the Canyon of the Ancients National Monument (BLM), Hovenweep National Monument (NPS), Ute Mountain Ute tribal lands, and communities (including Cortez and Dolores). A total of 114 miles of this scenic byway is located within Colorado.

Legal and Administrative Framework

Congress established the National Scenic Byways Program under the Intermodal Surface Transportation Efficiency Act of 1991 and strengthened it further with the passage of the Transportation Equity Act for the 21st Century in 1998 and subsequently with the Safe, Accountable, Flexible, and Efficient Transportation Equity Act - A Legacy for Users, in 2005.

The National Scenic Byways Program is under the administration of the U.S. Department of Transportation, Federal Highway Administration. Based on one or more archaeological, cultural, historic, natural, recreational, and/or intrinsic scenic qualities, the U.S. Secretary of Transportation recognizes certain roads as America's Byways, All-American Roads, or national scenic byways.

The Colorado Scenic and Historic Byways Program is a statewide partnership intended to provide recreational, educational, and economic benefits to Coloradoans and state visitors. This system of outstanding touring routes in Colorado affords the traveler interpretation and identification of key points of interest while, at the same time, providing for the protection of significant resources.

Scenic and Historic Byways are designated by the Colorado Scenic and Historic Byways Commission based on their exceptional scenic, historic, cultural, recreational, and natural features.

Backcountry Byways are vehicle routes that traverse scenic corridors utilizing secondary or backcountry road systems.

3.24.2 Affected Environment

Existing Conditions and Trends

Currently, driving for pleasure is one of the most popular forms of recreation occurring within the planning area—with scenic byways and backcountry byways serving as some of the most popular routes through the San Juan Mountains (experiencing moderate to high use on a regular basis).

Along these byways, many interpretive opportunities remain untapped and out of reach to the public. Valued scenic and cultural landscapes remain exposed to development and, consequently, degradation due to a variety of impacts. Basic safety information and sanitary facilities are still lacking in key areas.

As the population increases, and as baby boomers grow older and become less able to engage in more physically active forms of recreation, larger numbers of visitors are anticipated to take up driving for pleasure. Heritage tourism, which is the fastest growing segment of the tourism industry, is often combined with a scenic drive. Cultural heritage sites along byways (including early historic mining and Native American sites) offer increasing opportunities for interpretation and education.

3.24.3 Environmental Consequences

Direct and Indirect Impacts

Under all of the alternatives, the condition of the viewshed on the SJNF and TRFO would be conserved for valued scenic and cultural elements to the extent that partnerships, resources, and funding allow. Generally, all of the alternatives are similar with respect to desired future conditions, thematic direction, and design guidelines for land management of the routes (and adjacent lands) within the viewsheds. Differences exist between the alternatives regarding oil and gas stipulations (Table 3.24.1). In reference to oil and gas leasing stipulations, Alternatives A and D (under CSU)

would provide less scenic protection to these roads and trails than would Alternatives B or C (which prescribe NSO stipulations), although all propose more protective oil and gas stipulations. If no new oil and gas leases were made available, the impacts to scenic byways would be similar under all alternatives because most of the development would occur on existing leases only. The ability to move facilities to eliminate visual impacts may be limited by CSU, allowing surface occupancy within closer proximity of, or within the 0.5-mile corridors; therefore, visual impacts would have a higher probability of occurring under CSU than under an NSO requirement.

The PLAA contains approximately 20 miles of the 232-mile-long San Juan Skyway. In keeping with the primary goals of the National Scenic Byway Program, the management of surrounding landscapes is vital to the conservation of its unique and valued attributes.

The San Juan Skyway's corridor is characterized by steep, rugged terrain and traverses areas within the PLAA that have low oil and gas potential. The corridor's protective stipulation and the lack of resource potential within the corridor would both result in no to very minor development impacts to the San Juan Skyway where it passes through the PLAA.

Table 3.24.1: Oil and Gas Leasing Stipulations for Areas in Each Alternative

Area	Alternative A	Alternative B	Alternative C	Alternative D
National scenic byways, All-American Roads, and backcountry byways; designated scenic, recreation, and historic trails; and recreation-emphasis corridors: Within the identified foreground viewshed, up to 0.5 mile on either side of the following routes would be protected: San Juan Skyway, Trail of the Ancients, the Alpine Loop Back Country Byway, Old Spanish Trail, Continental Divide Trail, Colorado Trail, Calico Trail, Highline Loop Trail, East Fork Road, West Fork Road, First Notch Road, Piedra Road, Poison Park Road, Lime Creek Road, South Mineral Road, La Plata Canyon Road, West Dolores Road, and Durango-Silverton Narrow Gauge Railroad.	CSU/NSO	NSO	NSO	CSU

Cumulative Impacts

The main cumulative impact to these scenic routes is related to the development of non-public lands visible from, or adjacent to, these routes. These impacts are outside the scope of this FEIS. Over the next decade, many private parcels may be developed for residential and commercial use. Some of this development may cumulatively impact these byways. Changes in the character of the visible viewshed from these routes may be likely to occur, especially as lands become more industrial and urbanized. Under the No Leasing Alternative, none of the scenic byways would have any potential for oil and gas exploration.

A portion of the San Juan Skyway exiting the SJNF and traversing private lands between Dolores and Mancos is underlain by the GSGP. Oil and gas development of the private lands could degrade the scenic quality of that section of the San Juan Skyway as one travels south on the skyway on NFS lands.

3.25 National Recreation, Scenic, and Historic Trails

3.25.1 Introduction

National Recreation Trails: This is a designation given to certain publicly accessible trails in the United States that contribute to health, conservation, and recreation goals. There are approximately 1,000 national recreation trails currently designated in all 50 states, ranging from less than a mile to 485 miles long, which are located on local, state, federal, and privately owned lands. National recreation trails may be nominated for designation each year. The USFS and the NPS jointly administer the National Recreation Trails Program, with help from a number of other federal (including the BLM) and non-profit partners.

National Scenic Trails: This designation protects trails within areas of special natural beauty. National scenic trails are authorized under the National Trails Systems Act of 1968, along with national historic trails and national recreation trails. National scenic trails and national historic trails may only be designated by an act of Congress.

National Historic Trails: This designation protects extended trails that closely follow a historic trail or route of travel of national significance. Designation identifies and protects historic routes, historic remnants, and artifacts for public use and enjoyment.

Legal and Administrative Framework

The National Trails System Act of 1968: This act authorized the creation of a national trail system composed of national recreation trails, national scenic trails, and national historic trails. Although national scenic trails and national historic trails may only be designated by an act of Congress, national recreation trails may be designated by the Secretary of the Interior or the Secretary of Agriculture, in order to recognize exemplary trails of local and regional significance (in response to an application from the trail's managing agency or organization). Through designation, these trails are recognized as part of America's national system of trails.

3.25.2 Affected Environment

Existing Conditions and Trends

The Calico and Highline National Recreation Trails cross the planning area, typically within areas that are managed for semi-primitive recreation (ROS) opportunities. Neither of these trails are at or near their use capacity at this time.

The 22-mile Calico National Recreation Trail is a multi-use trail that stays above 8,500 feet in elevation, traveling along ridgelines and through forested areas. Mountain bikers and hikers share the trail with horseback riders and motorcycle riders. Consistent with its multi-use management, this trail has sufficient access from developed roads and trailheads.

The non-motorized Highline Loop National Recreation Trail crosses the planning area for approximately 17 miles with a minimum elevation of 9,000 feet. Within the planning area, this trail is also includes a portion of the Colorado Trail and follows a spectacular mountain ridgeline with long-distance views. Consistent with its primitive character, this trail has sufficient access from primitive four-wheel drive roads.

Acting upon a vision of a 3,100-mile primitive and challenging backcountry trail that would travel from Canada to Mexico along the backbone of America, Congress designated the CDNST in 1978. The CDNST Comprehensive Plan was completed in 2009, outlining management priorities and guidelines (USFS 2009).

A long section of the CDNST crosses the planning area, traversing the spectacular and remote high country of the San Juan Mountains within the Weminuche and South San Juan wilderness areas. From the Weminuche wilderness area, the CDNST travels north onto BLM-administered lands near Silverton. Most of this section of the CDNST meanders between the San Juan and the Rio Grande National Forests, necessitating shared management responsibility for many miles of this significant trail.

A CDNST management plan has been completed, identifying specific goals and objectives for trail segments and trailhead facilities. Current trailhead access and development is consistent with CDNST Comprehensive Plan direction. Issues related to trail alignment are nearly all resolved for sections managed by the SJNF and TRFO.

The Colorado Trail is Colorado's premier long-distance, non-motorized trail. Stretching almost 500 miles from Denver to Durango, it travels through the spectacular Rocky Mountains (including six wilderness areas and eight mountain ranges), topping out at 13,334 feet. Within the planning area, some of the Colorado Trail follows the same route as the CDNST. A portion of the Colorado Trail within the planning area follows the Highline Loop National Recreation Trail.

Within the planning area, most of the Colorado Trail travels within remote backcountry, wilderness areas, and other lightly traveled areas. Issues resulting from conflicts with motor vehicle use are few. The southernmost section of the Colorado Trail near Durango is heavily used by the community for day-use hiking and biking.

In 2002, Congress formally designated the Old Spanish Trail as the nation's 15th national historic trail. The "Main Branch" trail route is now under Highway 184, directly in front of the Dolores Public Lands Office. Between 1829 and 1848, the Old Spanish Trail was used by immigrants and traders on yearly pack-train expeditions between Santa Fe and the Pueblo of Los Angeles (San Gabriel Mission). The trail was used by trappers, travelers, and military expeditions. Some of the travelers on the Old Spanish Trail (in whole or in part) include Gunnison, Wheeler, Kit Carson, Rowland, Workman, Antoine Rubidium, Howard Ruffed, Pablo Vigil, and Antonio Amigo, to name but a few. This trail offers outstanding cultural tourism and interpretive opportunities.

3.25.3 Environmental Consequences

Direct and Indirect Impacts

In relation to the action alternatives, Alternative A would not propose the same viewshed protection for these trails as Alternatives B, C, and D. Alternatives B, C, and D all establish these trails as important viewer locations, and they do incorporate standards, guidelines, and stipulations designed to protect the foreground viewshed along these routes. Alternative B would impose varying degrees of viewshed protection, primarily dependent on the MA designation of the lands within which the routes travel. Via the MA allocations, Alternative B contains somewhat more restrictive management criteria than Alternative D, but to a lesser degree than Alternative C. Alternative C would allow the lowest potential for developments or other active management activities that would be visible from or otherwise affect the trails. On the contrary, Alternative D has the greatest potential for allowing developments that would be visible or otherwise affect the trail corridors. Other issues, including trail

access, shared use, way-finding, and maintenance, would not differ between the alternatives. If no new oil and gas leases were made available, the impacts to the national recreation and scenic trails would be similar to the impacts under all alternatives because most of the development would occur on existing leases.

Regardless of the alternatives, the 1968 National Trails System Act prevents land management agencies from taking actions that would directly and/or significantly alter the immediate surroundings of the trail corridors or that would degrade the specific resources for which the trail was designated.

Cumulative Impacts

The main cumulative impact for the future of these routes would be related to the development of non-public lands visible from, or adjacent to, these routes. This impact would be outside the scope of this FEIS. Over the next decade, private parcels near the trails would likely be developed for residential and commercial use. Some of this development may result in cumulative impacts to these scenic, historic, and recreational routes. Changes in the character of the visible viewshed from these routes are likely to occur, especially as lands become more industrial and urbanized.

3.26 Research Natural Areas

3.26.1 Introduction

RNAs are NFS lands that are part of a network of ecological reserves designated in perpetuity for non-manipulative research, education, monitoring, and for the preservation of ecological diversity. They are relatively unaltered by past management activities and managed to allow natural ecological processes to proceed with minimum human intervention. They also serve as reference areas for the study of ecological processes, disturbances, and ecological changes. Most management activities are prohibited in RNAs unless they are needed to achieve desired conditions or maintain the features for which the RNA was established. Forest plans shall include the analysis of proposed RNAs and shall make recommendations for the establishment of RNAs (FSM 4063.03). RNAs on the SJNF are protected areas and as such are key components of the LRMP sustainable ecosystems strategy.

The following objectives pertain to the establishment of RNAs:

1. Maintain a wide spectrum of high-quality areas that represent the major forms of variability in forests, shrublands, herbaceous lands, and other lands that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and the maintenance of biological diversity.
2. Preserve and maintain genetic diversity, including threatened, endangered, and sensitive species.
3. Protect against human-caused environmental disruptions.
4. Serve as reference areas for the study of natural ecological processes including disturbance.
5. Provide on-site and extension educational activities.
6. Serve as baseline areas for measuring long-term ecological changes.
7. Serve as control areas for comparing results from manipulative research.
8. Monitor effects of resource management techniques and practices.

3.26.2 Affected Environment

Existing Conditions and Trends

The SJNF currently contains two RNAs: Narraguinnep and Williams Creek. Twenty-one additional areas were proposed for RNA consideration through the LRMP revision process, primarily selected from roadless areas, vacant or closed grazing allotments, and lands with few management conflicts (Volume III, Appendix V, Map 72). Potential RNAs were selected to represent as much ecological diversity as possible, including vegetative, topographic, geologic, and climatic diversity and to include complete watersheds when possible. After further analysis, eight potential RNAs were recommended for RNA designation through this planning process because they represent most of the major vegetation types on the SJNF, they represent many of the vegetation types targeted for inclusion in the Rocky Mountain Region RNA system, and because they best meet RNA criteria (quality, condition, viability, and defensibility).

The Narraguinnep RNA is located on the west side of the SJNF about 13 miles northwest of Dolores. It contains about 1,900 acres at elevations ranging from 6,690 to 8,000 feet. Key features include old growth ponderosa pine forests, pinyon-juniper woodlands, mountain shrublands, steep canyon escarpments, and sedimentary geology.

The Williams Creek RNA is located about 15 miles northwest of Pagosa Springs. It contains about 550 acres at elevations ranging from 8,350 to 9,650 feet. Key features include white fir-dominated cool-moist mixed conifer forests, spruce-fir forests, gentle mountain topography, and volcanic geology.

The Electra RNA is located east of Electra Lake in the southern San Juan Mountains. It totals about 2,200 acres at elevations ranging from 7,400 to 8,800 feet. The area is characterized by glacial mountain topography associated with metamorphic and igneous geology. Key features include glacial topography, kettle ponds, old growth ponderosa pine forests, mixed conifer forests, aspen forests, wetlands, and fens.

The Grizzly Peak RNA is located in the Rico Mountains. It totals about 3,000 acres at elevations ranging from 10,000 to 13,700 feet. The area is characterized by rugged mountain topography. Three rock glaciers and a number of well-defined cirque basins occur within the RNA. Key features include periglacial topography, sedimentary geology, fens, old growth spruce-fir forests, willow carrs, alpine tundra, Thurber fescue mountain grasslands, and wetlands.

The Hermosa RNA is located about 13 miles north of Durango. It totals about 8,000 acres at elevations ranging from 7,000 to 12,000 feet. The area is characterized by highly dissected mountain topography and sedimentary geology. Key features include old growth forests, Colorado cutthroat trout, alpine tundra, spruce-fir forests, aspen forests, ponderosa pine forests, mixed conifer forests, and mountain shrublands.

The Hidden Mesas RNA is located about 15 miles southwest of Pagosa Springs. It totals about 4,400 acres at elevations ranging from 6,600 to 8,300 feet. The area is characterized by mesas, canyons, and sedimentary geology. Key features include old growth ponderosa pine forests, mixed conifer forests, pinyon-juniper woodlands, and mountain shrublands.

The Martinez Creek RNA is located about 9 miles north of Pagosa Springs. It totals about 1,800 acres at elevations ranging from 9,400 to 11,400 feet. The area is characterized by gentle to rugged

mountain topography and volcanic and sedimentary geology. Key features include old growth spruce-fir forests.

The Navajo River RNA is located about 19 miles east of Pagosa Springs. It totals about 7,000 acres at elevations ranging from 9,200 to 12,700 feet. It is located within the South San Juan wilderness area. The area is characterized by rugged mountain topography and volcanic geology. Key features include Colorado cutthroat trout, alpine tundra, spruce-fir forests, Thurber fescue mountain grasslands, riparian areas, wetlands, and fens.

The Piedra RNA is located about 23 miles northwest of Pagosa Springs. It totals about 6,900 acres at elevations ranging from 7,500 to 10,500 feet. It is located within the Piedra Area. The area is characterized by rugged mountain topography and volcanic geology. Key features include old growth warm-dry mixed conifer and cool-moist mixed conifer forests, spruce-fir forests, aspen forests, Thurber fescue mountain grasslands, riparian areas, and wetlands.

The Porphyry Gulch RNA is located about 21 miles north of Pagosa Springs. It totals about 12,000 acres at elevations ranging from 8,500 to 12,500 feet within the Weminuche wilderness area. The area is characterized by rugged mountain topography and volcanic geology. Key features include alpine tundra, spruce-fir forests, Thurber fescue mountain grasslands, riparian areas, wetlands, and fens.

3.26.3 Environmental Consequences

Direct and Indirect Impacts

The designation of RNAs would change the future management activities allowed in some areas. After designation, the implementation of management activities (fire management, livestock grazing, and recreation) in individual RNA management plans within the next 15 years would cause impacts to RNAs (as described below) on a small percent of the SJNF as described in Section 3.4, Riparian Areas and Wetland Ecosystems; Section 3.2, Terrestrial Ecosystems and Plant Species; and Section 3.16, Heritage and Cultural Resources. Natural ecological processes and disturbances (including succession, flooding, fire, insects, and disease) would also impact RNAs as evidenced by the spruce beetle epidemic that is currently killing Engelmann spruce trees in the proposed Martinez Creek RNA and as evidenced by the Narraguinnep Fire in the Narraguinnep RNA in 2009. LRMP components (desired conditions, standards, and guidelines) in the LRMP and in individual RNA management plans would prevent or minimize adverse impacts to RNAs.

Impacts Related to Recreation

Non-motorized and non-mechanized recreation activities (camping, hiking, horseback riding, outfitter guide activities, and trail maintenance) would cause impacts to the soils and vegetation (mostly along trail corridors) of RNAs on a small number of acres of the SJNF, as described in Section 3.2, Terrestrial Ecosystems and Plant Species; and Section 3.4, Riparian Areas and Wetland Ecosystems. Recreation would likely continue in RNAs at its current level unless it begins to adversely affect the ecological integrity of the RNAs.

Impacts Related to Fire Management

Prescribed fire (management-ignited fire and planned natural ignitions), which could be used to maintain or restore ecological conditions of RNAs, would cause impacts to the soils and vegetation of

RNAs potentially on a large number of acres of the SJNF, as described in Section 3.2, Terrestrial Ecosystems and Plant Species; and Section 3.4, Riparian Areas and Wetland Ecosystems.

Impacts Related to Livestock Grazing

Horses, mules, and llamas used for recreation activities (including those used by outfitter guides) would impact RNAs by trampling and grazing, and could impact RNAs by overgrazing, causing soil erosion or soil compaction (as described in Section 3.2, Terrestrial Ecosystems and Plant Species; and Section 3.4, Riparian Areas and Wetland Ecosystems) and by the introduction or spread of invasive plants that compete with native plants for space, water, and nutrients (Monz et al. 2009; Pickering et al. 2010).

Alternatives: Alternative C proposes the most RNAs, so it would provide the most lands for research, education, and reference sites; the most protection for biodiversity; and the most amount of protected areas. Alternative B proposes the second most RNAs, so it would provide the second most lands for research, education, and reference sites; the second most protection for biodiversity; and the second most amount of protected areas, followed by Alternative D. Alternative A proposes the fewest RNAs and would provide the fewest lands for research, education, and reference sites; the least protection for biodiversity; and the least amount of protected areas.

Cumulative Impacts

The past designation of RNAs did not cause adverse impacts to the SJNF and the future designation of RNAs, including ones associated with the LRMP and ones that could be designated in the foreseeable future on the SJNF (beyond the 15-year life of the LRMP), would not cause adverse impacts, so there would be no adverse cumulative impacts associated with designating RNAs.

Currently there are two RNAs on the SJNF that provide lands for research, education, and reference sites, protect the biodiversity in the planning area, and serve as protected areas. Additional RNAs designated through this LRMP and those that could be designated in the foreseeable future (beyond the 15 year life of the LRMP), would provide additional lands for research, education, and reference sites, would further protect the biodiversity, and would provide additional lands to serve as protected areas.

3.27 Areas of Critical Environmental Concern

3.27.1 Introduction

ACECs are BLM lands where special management attention is required to prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards (BLM Manual 1613). FLPMA mandates the BLM to give priority to the nomination and designation of ACECs through the development and revision of lands use plans.

3.27.2 Affected Environment

Existing Conditions and Trends

The TRFO currently contains one ACEC, the Mud Springs/Remnant Anasazi Culture ACEC. Twenty-two additional areas have been nominated for ACEC consideration through the LRMP revision process, primarily selected from potential conservation areas (PCAs) that were developed by the

Colorado Natural Heritage Program. A PCA, which often includes both federal and non-federal lands, represents the land needed to support the long-term survival of the rare species or plant communities within it. Nineteen of the twenty-two sites were further identified as potential ACECs because they met both the relevance and importance criteria described in BLM Manual 1613. Four potential ACECs are analyzed in the alternatives (Anasazi Culture, Grassy Hills, Gypsum Valley, and Silvey's Pocket). See Volume III, Appendix U for detailed information on ACECs, including descriptions and the analysis of all the nominated ACECs.

The current Mud Springs/Remnant Anasazi Culture ACEC is located in Montezuma County about 1 mile west of Cortez. Its elevation is 5,800 to 6,000 feet, its size is about 1,100 acres, and it is mostly associated with pinyon-juniper woodlands and mountain shrublands. It contains a portion of the original Anasazi Culture ACEC that was not designated as the Canyons of the Ancients National Monument in 2000. It is currently the only ACEC within the planning area. This ACEC meets the relevance and importance criteria due to its significant cultural values and rare plants, as described in Volume III, Appendix U.

The Grassy Hills potential ACEC is located in San Miguel County, situated on a sandstone bench southwest of the confluence of Gypsum Creek and the Dolores River. Its elevation is 6,700 feet and its size is 420 acres. This area contains rare needle and thread Great Basin herbaceous vegetation. This nominated area meets the relevance and importance criteria due to its rare plants, as described in Volume III, Appendix U.

The Gypsum Valley potential ACEC is located in San Miguel County about 14 miles southwest of Naturita. It contains BLM lands associated with the Big Gypsum Valley and Little Gypsum Valley PCAs. Its elevation is 6,100 to 6,500 feet, its size is about 18,931 aces, and it is mostly associated with semi-desert grasslands and semi-desert shrublands. The Gypsum Valley ACEC meets the relevance and importance criteria due to its rare plants and unique soils, as described in Volume III, Appendix U.

The Silvey's Pocket potential ACEC is located in Montrose County, 8.5 miles southwest of Bedrock, and includes mesa tops and a broad bench south of Coyote Wash. Its elevation is 5,300 to 5,800 feet and its size is 707 acres. This area contains rare Naturita milkvetch and aromatic Indian breadroot (*Pediomelum* sp.), as well as needle and thread Great Basin herbaceous vegetation. This nominated area meets the relevance and importance criteria due to its rare plants, as described in Volume III, Appendix U.

See Maps 73 and 74 in Volume III, Appendix V for a depiction of ACECs proposed for each alternative.

3.27.3 Environmental Consequences

Direct and Indirect Impacts

Implementation of management activities (including oil and gas development, solid minerals development, utility corridor development, livestock grazing, and recreation) in potential and existing ACEC units within the next 15 years would cause impacts to ACECs as described in the Section 3.2, Terrestrial Ecosystems; Section 3.4, Riparian Areas and Wetland Ecosystems; and Section 3.16, Heritage and Cultural Resources (BLM Manual 1613 [BLM 1988]). LRMP components (desired conditions, standards, and guidelines) in the LRMP and in individual ACEC management plans would prevent or minimize adverse impacts to ACECs and their relevance and importance values. Natural

ecological processes and disturbances (including succession, flooding, fire, insects, and disease) would also impact ACECs.

Alternative C would designate the most ACECs, so it would provide the most protection for the relevance and importance values and biodiversity. Alternative B proposes the second most ACECs, so it would provide the second most protection for the relevance and importance values and for biodiversity, followed by Alternative A. Alternative D would designate the fewest ACECs and would provide the least protection for the relevance and importance values and biodiversity.

Cumulative Impacts

The past designation of ACECs did not cause adverse impacts to resources within the planning area and the future designation of ACECs, including ones associated with the LRMP and ones that could be designated beyond the 15-year life of the LRMP, would not cause adverse impacts, so there would be no adverse cumulative impacts associated with designating ACECs.

Currently there is one ACEC that protects the biological diversity and the relevance and importance values. Additional ACECs designated through the LRMP and those that could be designated in the foreseeable future (beyond the 15-year life of the LRMP) would further protect the biological diversity and the relevance and importance values.

3.28 Wild Horses/Herd Management Areas

3.28.1 Introduction

The Spring Creek Basin HMA was designated in the 1985 San Juan/San Miguel Resource Management Plan (BLM 1985). The management document for the herd area, the Spring Creek HMA Herd Management Plan (BLM 1994), replaced the 1986 Spring Creek Basin Wild Horse Herd Management Area Plan (BLM 1986). The emphasis of the herd management plan focused on maintaining or improving resource conditions for wild horses, livestock, and eagle winter concentrations, as well as protecting the McKenna Peak WSA and controlling erosion and salinity in the HMA and Disappointment Creek watershed.

Wild horse management on BLM-administered lands of the TRFO follows the Wild Free Roaming Horse and Burro Act of 1971 (PL 92-195) and 43 CFR 4700, Protection, Management and Control of Wild and Free Roaming Horses and Burros.

3.28.2 Affected Environment

Current Conditions

The Spring Creek Basin HMA comprises approximately 21,932 acres of public and state land. The HMA is located in San Miguel and Dolores Counties, about 45 miles northeast of Dove Creek and 33 miles southwest of Norwood off San Miguel County Road 19Q.

The current Appropriate Management Level (AML) is 35 to 65 wild horses and does not include the current year’s foals. The AML was established in the 1994 Spring Creek Basin HMA Plan and reaffirmed in 2005 through the Spring Creek Grazing Allotment/Spring Creek Basin HMA land health assessment and determination (CO-800-2005-027-EA) following an in-depth analysis of habitat suitability and resource monitoring and population inventory data, with public involvement. This AML range is confirmed as the number of wild horses that can be maintained without causing rangeland

damage. In the future, if rangeland damage is accruing AML may be adjusted to prevent rangeland damage and make progress toward a thriving natural ecological balance. Establishing AML as a population range allows for the periodic removal of excess animals.

The current estimated population of wild horses is 52, with a herd sex ratio of 55% stallions/colts and 45% mares/fillies. This number is based on census surveys completed in spring of 2012 by volunteers with the Disappointment Wild Bunch Partners and BLM staff, and includes the 2012 foal crop (two foals at the time of the count, plus five mares yet to deliver). Wild horse numbers have increased an average of 18% per year since the HMA was last gathered, thereby reducing the frequency of gathers.

Horses were last gathered in September 2011. At that time, 53 wild horses were gathered, 40 removed, and 13 released back to the range. Of the released horses, five mares were treated with fertility control (Porcine Zona Pellucida, PZP-22) vaccine and freeze marked with the letters “DC” on the left hip. Post-gather, an estimated 40 wild horses remained within the HMA.

Topography varies from open, rolling hills to rugged mountainous country to the north, south, and east boundaries. Elevation ranges from 6,200 to 7,400 feet. Precipitation averages from 12 to 16 inches per year.

Vegetation varies from salt desert shrub community in the valley and piñon-juniper woodland on the slopes and higher elevations. Green rabbitbrush, shadscale, black sage, galleta grass, Indian ricegrass, winterfat, and needle and thread grass make up the primary forage items in the horses' diet.

At various times of the year, the HMA provides habitat for elk, mule deer, bald eagles, golden eagles, peregrine falcons, coyotes, prairie dogs, and the occasional black bear and mountain lion. Rattlesnakes are common throughout the HMA. Recreational opportunities include hunting, sightseeing, and access to the McKenna Peak WSA.

The Spring Creek Grazing Allotment No. 17056 is the only grazing allotment that encompasses the HMA. This grazing allotment is slightly larger than the HMA, as it includes a section of state land and a lesser amount of public land, in the Klondike Basin area that is not within the HMA. Based on EA No. CO-800-2005-027 EA, on May 27, 2005, the BLM issued a grazing decision reducing the permitted livestock (Table 3.28.1).

Table 3.28.1: Permitted Livestock Grazing Reductions in the Spring Creek Basin Herd Management Area

Spring Creek Basin HMA	Livestock		Grazing Period		Percent Public BLM	
	Numbers	Kind	Begin	End	Land	AUMs
Original Numbers	180	Cattle	12/01	02/28	94%	501*
Reduction Numbers	125	Cattle	12/01	02/25	88%	326*

* AUM refers to animal unit month, defined as the amount of forage required to sustain one cow, or its equivalent for one month.

A second grazing permit for another 400 public land livestock AUMs in the HMA was acquired by the National Mustang Association in 1999 and relinquished by in 2002. As a result, 2,079 BLM livestock grazing AUMs have been cancelled or retired within the HMA in the last 20 years, with 326 remaining active. This 86% reduction in BLM livestock AUMs has increased plant production and availability for use by the horses and wildlife species, as well as soil protection.

Trends

Eight gathers have been held between 1985 and 2011. Gathers have been conducted every 2 to 6 years, dependent on herd size and rangeland health conditions. After the 2011 gather, 13 mares have been treated with PZP-22, a fertility control drug requiring a first time primer and subsequent annual booster. The program includes mares released during the most recent gather, as well as other mares identified for PZP-22 treatment in the 2011 gather Spring Creek Basin EA Decision Record (DOI-BLM-CO-S010-2011-0062DR). Mares and stallions from other herds have been introduced while removing Spring Creek horses in order to increase the genetic diversity, as well as color and conformation. The *Genetic Analysis of the Spring Creek Basin HMA, CO* (Cothran 2010) states that the small herd size requires the introduction of mares from other herds that could restore variability without having a major impact on the genetic character of the herd or population size.

Continuation of the PZP-22 program combined with the introduction of mares from other herd areas should allow for a genetically diverse and viable herd while reducing the number of horses removed through approved gather methods.

3.28.3 Environmental Consequences

Direct and Indirect Impacts

Following the passage of the Wild Free-Roaming Horses and Burros Act in 1971, the BLM was directed to identify areas where wild horses and burros were located. These areas were designated as herd areas. Through land use planning, the BLM evaluated each herd area to determine if sufficient food, water, cover, and space were available to support long-term healthy and diverse populations of wild horses and burros. Areas that met these criteria were then designated as HMAs.

General Impacts

Impacts on wild horses often result from activities that disrupt horse herds or have an impact on range resources that support healthy herds. Range resources such as water and forage are not only impacted by climatic conditions or wildlife but also by any surface-disturbing activities such as oil and gas or solid mineral development. Ongoing grazing, recreation, and energy or mineral development in the Spring Creek Wild Horse HMA could affect range resources including forage, water, habitat, or the wild horses themselves.

The primitive character of the Spring Creek Wild Horse HMA is an important part of the success of the wild horse program. Management that maintains the character of the basin where human pressure is minimized by limited roads, rough topography, and the remote nature of the area preserves the integrity of the HMA. Management activities that disturb the herd’s use of habitat or elevate the human interaction with the herd impedes normal wild horse behavior while reducing the wild and free-roaming nature of wild horses.

In some circumstances, manipulation of the ecosystem could occur in order to maintain or improve range resources. These actions include horse gathers (bait trapping or helicopter gathers), seeding, and stock pond improvements or development. In these situations, there may be no major adverse impacts to the composition, structure and/or function to the wild horses or HMA. Impacts described in this section could occur under all of the alternatives.

Impacts Related to Livestock and Rangeland Management

Dependent on the alternative that is chosen, livestock grazing would or would not occur in the HMA.

If grazing continues, the annual season of use would be December 1 to February 28. Grazing would be closely monitored so that adverse ecological impacts would not occur and a healthy ecosystem is maintained.

Healthy uplands, watersheds, and soils would increase the potential for increased forage and water productivity that would indirectly benefit wild horses and big game animals. Management actions designed to reduce erosion, control salinity, or improve soils and vegetative cover could indirectly benefit wild horses and big game by increasing forage and maintaining or improving plant communities. It would also limit competition for forage between wild horses and big game animals.

Managing riparian areas and springs in proper functioning condition would provide reliable water sources for all users of the range. Maintaining as many water sources as possible within the HMA allows the greatest opportunity to disperse the population of wild horses.

Alternative C proposes to close the allotment in the HMA and remove 326 AUMs. The AML of 35 to 65 wild horses in the HMA would continue to be monitored to ensure there are healthy wild horses on healthy rangelands. Removal of grazing could result in a stable or general upward trend in the conditions of the ecosystem in the Spring Creek Wild Horse HMA

Current cattle grazing in the HMA occurs in the winter when plants are dormant, indirectly affecting plant vigor. The removal of cattle grazing maintains or improves rangeland health by leaving more residual plant material on the ground, which aids in maintaining or improving soil stability and controlling salinity issues that affect the Disappointment Creek watershed. Alternatives A, B, and D would not change the current direction of management in the basin.

Impacts Related to Recreation

The current level of hunting, sightseeing, and access to Spring Creek Basin and the McKenna Peak WSA and other low-impact recreational uses of the basin would continue unless the use(s) pose a threat to the values for which the HMA was established. Impacts associated with these activities may be minor and may impact a small percentage of the acreage within the HMA. However, the construction of new roads would be prohibited except to correct resource damage or access minerals. The impacts of recreation in the HMA would be similar under all alternatives.

Impacts Related to Invasive Plant Species Control

Within the planning area, invasive plant species would be controlled, where feasible, in order to protect the unique features for which the HMA was established. The impacts of these treatments would not adversely impact native species, plant communities, or wild horses. The impacts of invasive plant species control in the HMA would be similar under all alternatives.

Impacts Related to Fire Management

Wildland fire would have varying impacts to wild horses and the HMA dependent on the size, timing, and locality of the fire. Wildland fire could displace, injure, or kill horses. Short-term impacts include forage reduction, while long-term impacts could improve forage production. Size and intensity of wildland fire would remain low due to the limited fuel types in the basin except in the denser pinyon-

juniper woodlands near the boundaries of the HMA. The impacts of wildfire in the HMA would be similar under all alternatives.

Impacts Related to Minerals and Energy Development

Solid and fluid minerals extraction could temporarily or permanently remove forage for wild horses, depending on the location of the mineral extraction project. Activities associated with exploration (including geophysical seismic operations) and extraction could disrupt herd dynamics and increase human interaction with the herd. Withdrawal or closure of areas for mineral development would reduce the potential for impacts to the herd and HMA. However, leasable and locatable mineral extraction would be allowed under all alternatives but subject to restrictions through stipulations to protect resources.

Dependent on the alternative, the application of CSU would require NSO within a 2,000-foot radius around mapped water sources in the Spring Creek Basin HMA. The intent of this stipulation is to prevent disruption to horses when seeking water and to protect water quality. In addition, any oil and gas well pads within the HMA would require fencing and gates during development, production, and reclamation to prevent both horse access and unauthorized vehicle travel to production facilities. In order to protect wild horse foaling, disturbance (such as vehicle use associated with energy production) must be infrequent and of low impact except on designated roads. The TL to protect wild horse foaling is applicable to all alternatives, while CSU to protect water sources is applicable only to Alternatives B and C.

Impacts Related to Lands and Special Uses

Short- and long-term impacts from lands and realty actions including power and pipeline infrastructure, land transfers, other ROW projects, or Special Use Permits (filming) could displace or disrupt wild horses and remove forage. Actions would be restricted to minimize disruption to the herd. The impacts of lands and realty actions in the HMA would be similar under all alternatives.

Cumulative Impacts

The planning area currently has one wild horse HMA. Alternative C would close the allotment (cattle grazing) in the HMA while maintaining the current AML of 35 to 65 wild horses. There are no adverse ecological impacts related to the ongoing management of wild horses. Therefore, there would be no adverse cumulative impacts associated with the management of wild horses in the Spring Creek Wild Horse HMA.

3.29 Economics

3.29.1 Introduction

Economic consequences of managing the SJNF and TRFO stretch across Colorado, New Mexico, Arizona, and Utah. While the planning area contains portions of eleven counties within Colorado, a five-county area that includes Archuleta, Dolores, La Plata, Montezuma, and San Juan Counties is recognized as the most affected region by the management of these public lands and serves as the focus of the economic analysis. San Juan County, New Mexico, is a significant provider of support activities to the oil and gas industry in southwest Colorado and is therefore discussed in the context of minerals management on the SJNF and TRFO. In this section, San Juan County, New Mexico, would also be referred to as Farmington, given its classification as a micropolitan statistical area by the U.S.

Census Bureau. The base year of this section has been updated from 2004 (used in the Draft EIS and Supplement to the Draft EIS) to 2010.

A portion of new natural gas activity addressed in the Supplement to the Draft EIS and the FEIS is expected to occur in the remote, southwest parts of San Miguel County. Unlike other Colorado counties in the area with natural gas resources, few economic transactions are expected to occur within San Miguel County. Given existing transportation systems and the location of oil and gas industry support in southwest Colorado, materials and labor are expected to be brought into and out of the county from the south during both field development and production. Because business transactions within San Miguel County associated with natural gas within the SJNF and TRFO are expected to be minimal, the county is not included in the economic impact area.

Comprehensive economic data are generally unavailable at the community level. However, interpretations of larger-scale analyses can sometimes be made and offer insights into particular communities. These are presented where possible.

The population impacts that flow from the economic impact analysis are presented in Section 3.30, Demographics. Fiscal impacts to local governments are provided in Section 3.31, Local Governments. Because decisions associated with this FEIS potentially affect the fiscal conditions of local government jurisdictions differently than more general economic conditions, the reader is encouraged to note geographic area distinctions between this section and Section 3.31. For example, economic impacts of natural gas development and production are expected to be minimal in San Miguel County, while fiscal impacts of natural gas production are expected to be important.

Changes since the Draft Environmental Impact Statement and Supplement

Important changes in economic conditions and SJNF and TRFO management have occurred since the Draft EIS and Supplement to the Draft EIS were prepared. The most influential change has been shifting the base year to 2010. The Draft EIS and Supplement to the Draft EIS used a base year of 2004. In 2004, the U.S. economy was in the midst of a housing boom, the stock market was strong, and consumer spending was vibrant. By 2010, the United States was still reeling from a severe recession with no sign of a housing recovery. Consumers were focusing on personal debt reduction, and capital was extremely difficult to obtain for business and households alike. To ground the economic analysis of this FEIS in the most recent available data and to use the best available science, the new base year was moved to 2010.

Commodity prices are a very influential factor in the economic contributions and effects discussed below. Timber stumpage from the SJNF was $18 per MMCF of sawtimber in 2004; it was $7 in 2010. Natural gas prices in Colorado were $5.21 per MMCF in 2004 and $3.96 in 2010. Forage in Colorado was $13.50 per AUM in 2004; it was $15.32 in 2010. These price changes profoundly affect the relationship between employment, wages, and sales of output across many industries. Even if the economic models and management activity by alternative had been held constant, analysis results would be different.

IMPLAN, the proprietary input-output economic modeling system used for the economic analysis in the Draft EIS, Supplement to the Draft EIS, and FEIS, has also changed since the Draft EIS was prepared. New data and estimation methodologies have improved dramatically over the years. Because of these upgrades, prior year models and estimates are not always comparable to the latest estimates. The latest versions of IMPLAN modeling data (2010) and software (2011) were used for the FEIS.

Physical resource outputs by alternative that have economic implications were held constant in some cases and updated in others. Natural gas development/production and wood products production were updated from the Draft EIS/Supplement to the Draft EIS. Grazing levels were unchanged. Recreation use and spending profiles were updated, but they remain constant across alternatives.

Financial activities tied to managing the SJNF were also updated. Budgets and employment were revised, even though they remain constant across alternatives. Federal payments to local governments were also updated and revised to be more comprehensive and consistent with state regulations.

The year of comparison among alternatives was shifted from 2015 in the Supplement to the Draft EIS to 2020 in this FEIS to better represent full plan implementation and relate to economic projections of the area. While this shift did not affect output levels for most resources, it did affect representation of natural gas development. The rate of growth projected for basin development in the Supplement to the Draft EIS is unchanged for the FEIS. However, 2020 in the FEIS represents a point 3 years further down the growth path in basin development than 2015 in the Supplement to the Draft EIS. Consequently, the reader will find notable increases in the economic effects of the SJNF and TRFO minerals program compared to the Supplement to the Draft EIS.

Unchanged from the Supplement to the Draft EIS is the inclusion of the No Leasing Alternative required by regulation. Only oil and gas activity was analyzed for this alternative. To maintain a level of continuity in tables from the Draft EIS and Supplement to the Draft EIS, results for the No Leasing Alternative are provided in the text only.

Legal and Administrative Framework

Laws

- **The National Environmental Policy Act:** NEPA requires that consequences to the human environment be analyzed and disclosed. The human environment includes economic and social, as well as physical and biological, components of the affected area. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during the public involvement process, from scoping through preparation of the FEIS.
- **The National Forest Management Act:** This NFMA requires examination of local economic impacts and economic cost-efficiency considerations when preparing or revising land management plans.
- **The Federal Land and Policy Management Act:** FLPMA and its implementing regulations require a systematic interdisciplinary approach to achieve integrated consideration of physical, biological, economic, and social effects consistent with NEPA.

3.29.2 Affected Environment

Employment and Income

Current distribution of employment by industry, trends in employment, and average earnings per job are important measures of an area’s economic condition. Employment is reported by the Bureau of Economic Analysis and by the Colorado Department of Local Affairs on an annual monthly average basis. This means that 12 monthly employment estimates are averaged for the given year. For sectors that are highly seasonal (with high employment during several months and low employment during the remainder of the year), the estimates may seem low; they are, however, correct. Sectors

with a sizeable stake in tourism, such as lodging and restaurants, are among those with highly seasonal employment. Employment and income data for San Juan County, New Mexico, are provided by IMPLAN (IMPLAN Group, Inc. [IMPLAN, Inc.] 2011). These data are derived from a variety of federal government sources, such as the U.S. Census Bureau, the Bureau of Economic Analysis, and the Bureau of Labor Statistics.

Table 3.29.1 and Table 3.29.2 show that in 2010 service industries were the leading employer in both the five-county Colorado and Farmington, New Mexico, areas. Because both Durango and Farmington are regional service centers and host a sizeable tourism industry, services dominate their respective economies. Visitor services include lodging, food and drinking establishments, and firms that provide recreation services (e.g., downhill skiing, whitewater rafting, and theater groups) accounted for 12% of employment in southwest Colorado and 8% in Farmington. Other services that include real estate, information, professional, administrative, and personal service firms provided a third of total jobs in the Colorado area, but only 9% in the Farmington area. In 2010, mining (which includes oil and gas) accounted for just 2% of all jobs in the five-county area, but over 11% in the Farmington area. Construction provided from 8% to 9% of all jobs in both areas. Government employment was also very similar in both areas, accounting for 18% of total employment. Manufacturing was the smallest sector in each region.

Table 3.29.1: Employment (jobs) by Major Industry in the Five-county Colorado Area, 2010

Industry	Total Jobs
Agriculture	1,799
Mining	1,030
Construction	4,642
Manufacturing	1,114
Transportation and utilities	1,541
Trade	6,542
Visitor services	6,045
Other services	17,149
Government	9,318
Total	**49,180**
Source: Colorado Department of Local Affairs, State Demography Office (2011).	

Table 3.29.2: Employment (jobs) by Major Industry in San Juan County, New Mexico, 2010

Industry	Total Jobs
Agriculture	1,675
Mining	6,890
Construction	4,888
Manufacturing	1,339
Transportation and utilities	2,845
Trade	9,034
Visitor services	5,491
Other services	17,837
Government	11,031
Total	61,030
Source: IMPLAN, Inc. (2011).	

Employment in the five-county area has generally held steady from 2005 to 2010, but is expected to grow at a rate of 2.25% out to 2030. Figure 3.29.1 shows the recent history of total employment in the

area, as well as projections prepared by the Colorado State Demography Office. Figure 3.29.2 shows that employment in San Juan County, New Mexico, has also been somewhat flat since 2005, but is expected to grow at a rate of 1.8% out to 2020. Projections beyond 2020 are not available.

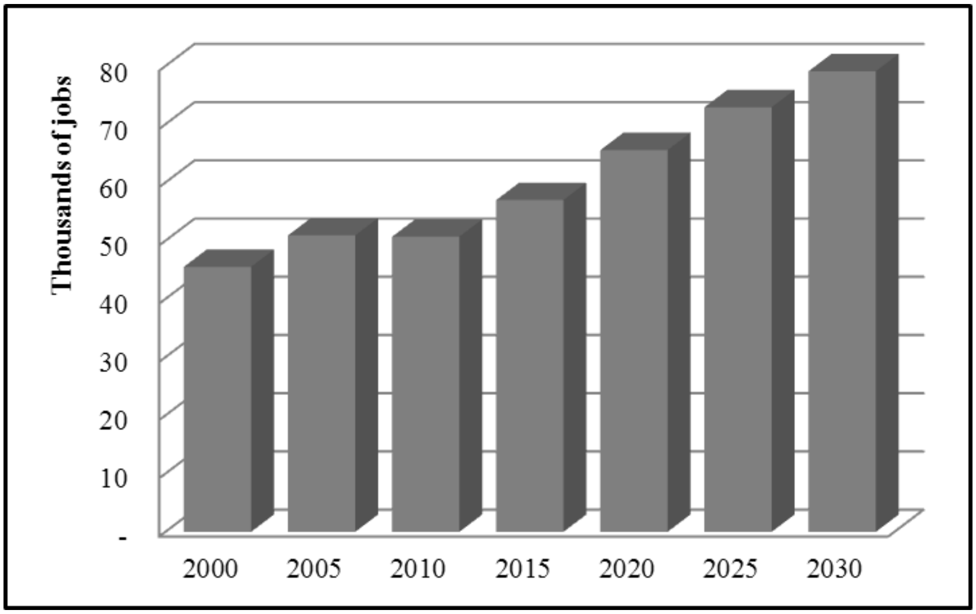


Figure 3.29.1: Employment (jobs) Forecast for the Five-county Colorado Area, 2000–2030
(Source: Colorado State Demography Office 2012b)

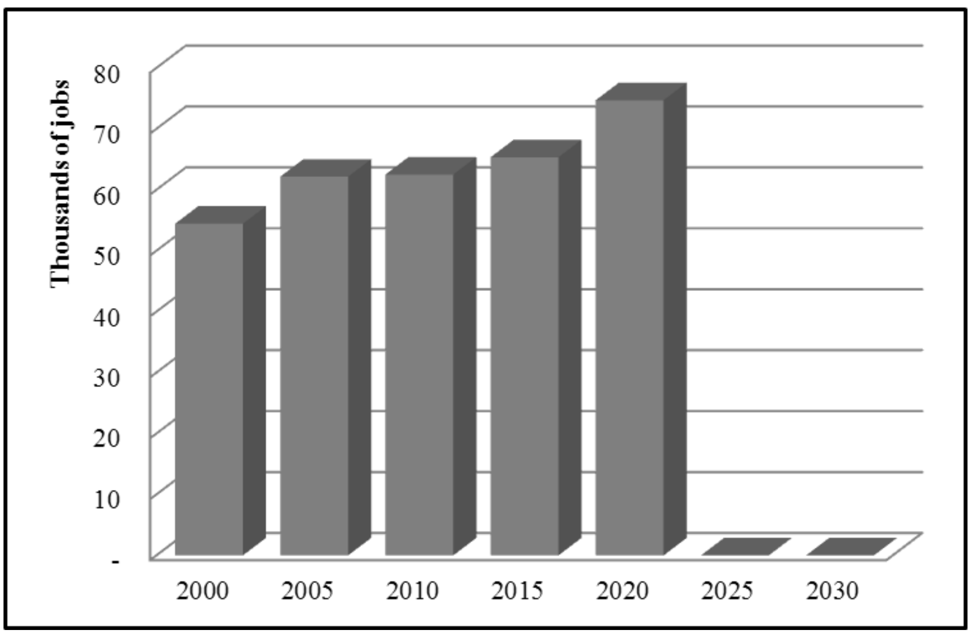


Figure 3.29.2: Employment (jobs) Forecast for San Juan County, New Mexico, 2000–2030
(Source: Bureau of Economic Analysis 2012; New Mexico Department of Workforce Solutions 2012)

Table 3.29.3 and Table 3.29.4 show labor income in 2010 for the two areas. Labor income includes all wages and salaries, plus benefits, for employees, as well as for the self-employed. This table follows the same pattern shown above for employment. Labor income, also called earnings, ranges from $12,800 per job in agriculture to $115,400 in mining for the five-county area. In the Farmington

area, the range starts at $16,100 per job for visitor services and tops out at $86,300 for transportation and utilities. With the exception of mining, earnings per job in the five-county Colorado area are generally lower than Farmington. Areas abounding with high-valued amenities, such as southwest Colorado, often draw an excess labor force that can dampen wages. Workers would often hold down multiple jobs at lower wages rather than move away to areas with lesser amenities.

Table 3.29.3: Labor (jobs) Earnings by Major Industry in the Five-county Colorado Area, 2010

Industry	$ Million	$ per Job
Agriculture	$23.1	$12,846
Mining	$118.8	$115,430
Construction	$159.1	$34,262
Manufacturing	$36.8	$33,050
Transportation and utilities	$99.6	$64,626
Trade	$197.4	$30,168
Visitor services	$106.5	$17,622
Other services	$672.1	$39,189
Government	$485.3	$52,080
Total	$1,898.7	$38,606
Source: Colorado Department of Local Affairs, State Demography Office (2011); IMPLAN, Inc. (2011).		

Table 3.29.4: Labor (jobs) Earnings by Major Industry in San Juan County, New Mexico, 2010

Industry	$ Million	$ per Job
Agriculture	$36.9	$22,022
Mining	$569.1	$82,597
Construction	$240.2	$49,140
Manufacturing	$62.6	$46,733
Transportation and utilities	$245.5	$86,305
Trade	$308.4	$34,138
Visitor services	$88.1	$16,054
Other services	$712.3	$39,932
Government	$573.3	$51,973
Total	$2,836.4	$46,475
Source: IMPLAN, Inc. (2011).		

Another important aspect of an economy is the sources of personal income for workers and residents. Personal income, as shown in Figure 3.29.3, is composed of three parts: 1) labor earnings that represent wages, salaries, and self-employed income; 2) investment income that represents revenue from dividends, interest, and rent; and 3) transfer payments, which are primarily government payments to individuals (including Social Security, Medicare, and Medicaid).

Labor earnings are considered to be "earned income." Transfer payments and investment income are considered to be "unearned income." As an established destination for retirees and those in their mid- or late-career stage, unearned income is becoming increasingly important in southwest Colorado. At 41%, the five-county Colorado area exceeds statewide averages, as well as the national average, in its share of unearned income. A quarter of all personal income comes from investments. In the Farmington area, non-earned income is about 35% of total personal income. Nearly a quarter of all personal income comes from transfer payments. Areas with a high percentage of personal income that is unearned are generally less vulnerable to local economic fluctuations, but may be more

vulnerable to national economic shocks. Transfer payments largely consist of Social Security payments—a very stable, if somewhat small source, of income. Areas with a high proportion of transfer payments generally experience less vulnerability to changing economic conditions.

As a population ages, unearned income generally increases as a percentage of total personal income. A relatively high level of investment income in southwest Colorado is consistent with a somewhat older population compared with residents in the Farmington area (Bureau of Economic Analysis 2012).

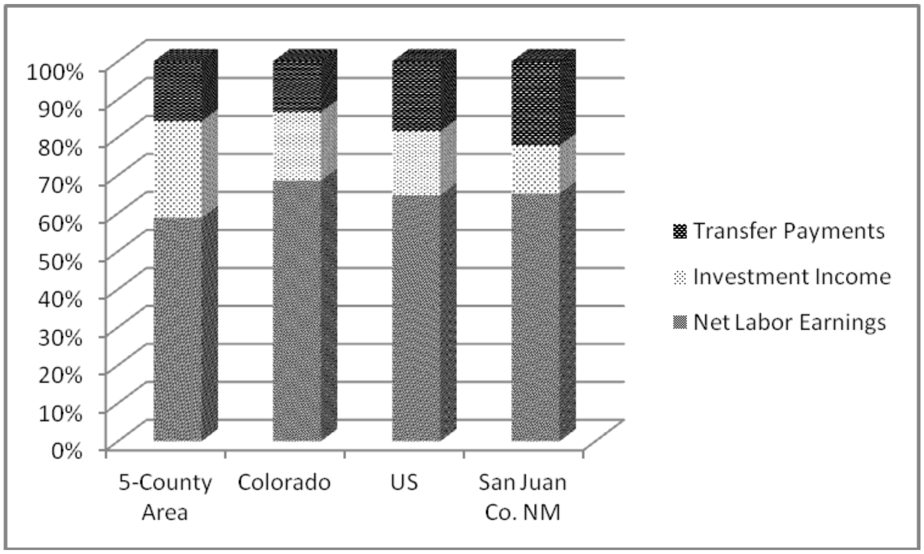


Figure 3.29.3: Shares of Personal Income by Source by Region, 2010 (percent)
(Source: Bureau of Economic Analysis 2012)

Personal income in the five-county area generally increased from 2000 to 2010, but is expected to grow at over 5% annually out to 2030. Figure 3.29.4 shows the recent history of personal income in the area as well as projections prepared by the Colorado State Demography Office. Figure 3.29.5 shows that personal income in San Juan County, New Mexico, has also generally increased from 200 to 2010. Projections beyond 2010 are not available.

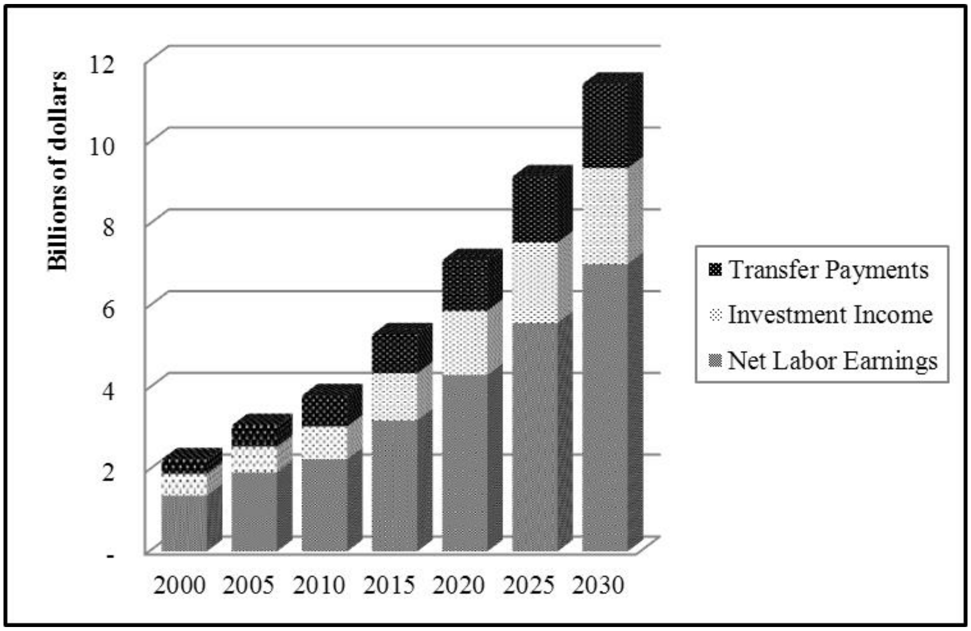


Figure 3.29.4: Personal Income (dollars) Forecast by Source for the Five-county Colorado Area, 2000–2030 (Source: Colorado State Demography Office 2012b)

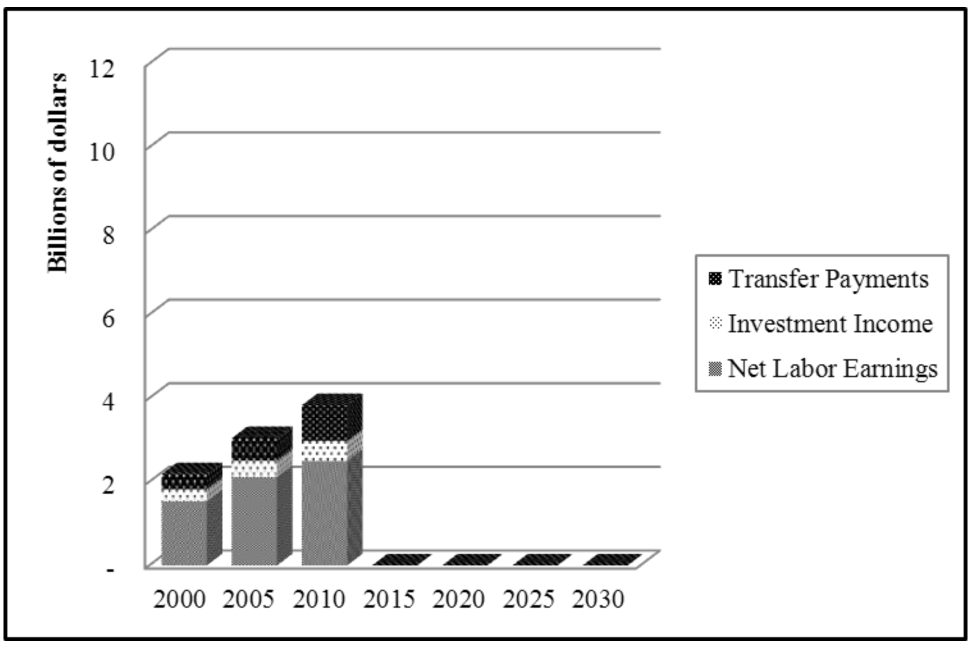


Figure 3.29.5: Personal Income (dollars) Forecast by Source for San Juan County, New Mexico, 2000–2030* (Source: Bureau of Economic Analysis 2012); *forecasts unavailable

Major Communities in the Planning Area

While the planning area contains portions of 11 counties within Colorado, a five-county area that includes Archuleta, Dolores, La Plata, Montezuma, and San Juan Counties is recognized as the most affected region by the management of these public lands and serves as the focus of the economic

analysis. These five counties have the greatest acreage and population associated with the planning area.

Archuleta County

Pagosa Springs is the only incorporated town on the east side of the five-county area and is a small service center for the surrounding rural vicinity. Ample sources of developed water, as well as large areas of developable and desirable private land, have made the Pagosa Springs area a favorite spot for residential development. The tourism market is active throughout the year, with a range of recreation opportunities in the summertime and with downhill skiing at Wolf Creek ski area in the winter.

La Plata County

Durango, located at the junction of U.S. Highways 160 and 550, is the seat of La Plata County, and economic hub of the five-county Colorado area. Long established as a professional service and retail center, Durango is also the tourism hotspot of southwest Colorado. With a ski resort and a long list of summertime, wintertime, and shoulder-season recreational opportunities, tourism remains the largest employer (and source of income). However, education (including Fort Lewis College) and government also play important roles. Amenity-driven migration and retirement bring non-labor income into residents’ mailboxes, creating additional economic activity. As in most of the San Juan region, real estate development, sales, and financing are important sectors. In terms of employment opportunities, the oil and gas industry is relatively small; however, the jobs that they do provide pay very well and are an important economic asset.

The other towns in La Plata County (Bayfield and Ignacio) are, for the most part, economically tied to Durango. They are, however, increasingly developing their own economic momentum, including Native American tribal investments. The Sky Ute Casino is owned by the Southern Ute Indian Tribe and is one of two gaming businesses owned and operated by tribes in Colorado. The other is located in Montezuma County.

Montezuma County

Cortez serves as a service and supply center for the Montezuma Valley and the west end of the five-county area. Continued efforts by community leaders to promote Mesa Verde National Park, as well as other attractions, and business investments in lodging, restaurants, and entertainment, make Cortez a major player in the regional tourist market. Although the real estate development is different in character and occurs at a slower pace, Montezuma County is experiencing a significant amount of activity in the real estate market.

Towaoc, headquarters for the Ute Mountain Ute Tribe, is home to several tribal businesses, including the Ute Mountain Casino. The town also includes retail shops, Bureau of Indian Affairs offices, and a clinic run by the U.S. Indian Health Service.

Growth in the Town of Mancos, and in the Mancos Valley, is driven, in part, by its commuting proximity to both Durango and Cortez. The productive agricultural lands south of U.S. Highway 160 have remained primarily in agricultural use. Ownership, however, is beginning to move from traditional ranching families to affluent buyers who pursue ranching or horse-breeding/training as an amenity lifestyle. A major attraction in the northern part of the Mancos Valley is the area’s proximity to the boundary of the SJNF.

The Dolores River valley is another important area within Montezuma County. Lying upriver and to the east of Dolores, its scenic appeal, and proximity to Telluride have resulted in the escalation of land values throughout the valley. The construction of McPhee Reservoir has limited the expansion of the town of Dolores downriver and to the west.

Dolores County

The western, or Dove Creek, side of Dolores County was settled in the 1800s around dry-land farming. The availability of irrigation water from the Dolores Project has benefitted the agricultural industry and rural communities in recent years. Historically, farmers and rural residents outside Dove Creek had to haul water in for domestic use. Beginning in the 1990s, rural domestic water supplied by Montezuma Water Company was extended into rural Dolores County. This prompted an increase in residential settlement, much of it in the form of 35-acre parcels. A primary appeal of western Dolores County is its wide-open vistas.

The eastern, or Rico/West Fork, side of Dolores County is characterized by forested, mountainous landscapes. For the most part, limited private land is confined to the river valley floor. Property in the West Fork has become high value, with both seasonal and year-round homes being developed. Rico has grown in recent years because of both a workforce that commutes into Telluride and an increasing population of seasonal and retired residents.

San Juan County, Colorado

The intensity of high-altitude winters coupled with the seasonal nature of summer tourism generated by the Durango to Silverton Narrow-Gauge Railroad and the “Million Dollar Highway” has resulted in a significant number of seasonal residents in San Juan County. In recent years, Silverton has been discovered by those seeking pleasant summer weather and unique recreational opportunities. In response to increased interest in seasonal homes, property values have been rising steadily.

San Juan County now contains the newly developed Silverton Mountain ski area. There have been concerted attempts to make Silverton more of a winter destination and smooth out some of the seasonal economic fluctuations. The ski area is the most significant move towards accomplishing this.

San Juan County, New Mexico

With a number of smaller cities around Farmington, such as Aztec and Bloomfield, San Juan County is the third most populated county in New Mexico. These cities first provided supplies to ranching and Native American communities, followed in the early 1950s with the discovery of oil and natural gas. Today Farmington is both an energy development and regional service center providing essential goods and services throughout the Four Corners area. The nearest population centers exceeding San Juan County in size are Albuquerque, New Mexico, to the southeast and Grand Junction, Colorado, to the north—both about 200 miles.

Durango is about a 1-hour drive from Farmington and within its regional trade circle. With less than 2% of the workforce in either La Plata County or San Juan County commuting between these centers (U.S. Census Bureau 2011), the labor connection between these centers has all but disappeared.

Cost of Living

The cost of living in the Rocky Mountain West can be somewhat higher than it is in other parts of the country, especially the Midwest and South. A recent study by Colorado State University indicates that the cost of living across Colorado, and in the five-county Colorado area, varies greatly.

Figure 3.29.6 shows how area counties compare with other parts of Colorado. La Plata and San Juan Counties are in the higher range of Colorado counties, Archuleta and Montezuma Counties are near the mid-range, and Dolores County is the most affordable. Housing costs are highly influential in the overall cost of living; therefore, the index is also a good indicator of real estate values. San Juan County, New Mexico, is more affordable than La Plata County, but more expensive than Montezuma County (Sperling's Best Places 2012).

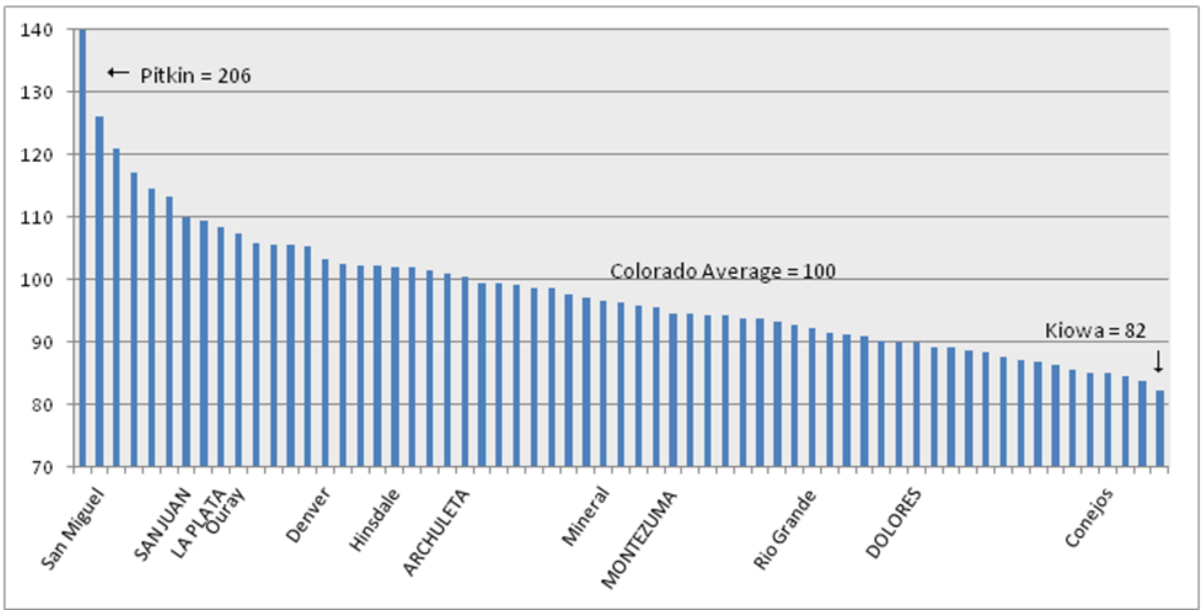


Figure 3.29.6: Cost of Living Index for Colorado Counties, 2007 (Source: Sullins and Garner n.d. [2007].)

Economic Dependency

Every economy has one or more "engines" that ultimately provide residents with jobs and income. In a real sense, every job and dollar of income in an economy depend on the size and vitality of these engines.

The economic dependency of the planning area can be discerned by breaking down employment into three components: direct, indirect, and induced. The direct component (sometimes called "basic") is that which brings money in from outside the area. The most visible form of this is the exporting of goods and services, or selling them to non-residents. Tourism is an excellent example of an export industry in the planning area. Other export industries include agriculture and mining. While these industries are often viewed as the principal exporters of a region, they are not alone. In fact, a portion of every industry sells goods and services to non-residents. This export activity is an important "engine" or "driver" for a local economy. While exporting is the most recognized engine in an economy, it is not the only one and may not be the most important. Sales to government, capital investments, and household spending of outside income can also be very important economic drivers. As noted above in the discussion of personal income, outside income includes transfer

payments, investments (dividends, interest, and rent), and wages paid by businesses located outside the area. Once spending in the local economy is started by these four engines, indirect and induced effects are triggered.

The indirect component of an economy supports the production of direct or basic activities by supplying a variety of goods and services as inputs to their production. Wholesale trade and trucking would be examples of indirect components in the economy. Many firms are involved in the supply chain of local businesses, even those that are considered exporters. For example, ranches that export cattle may also sell to local restaurants. Supply chains throughout a local economy can be quite complex.

The induced component of an economy (sometimes called “local resident services”) is the final piece. This component is founded on the payrolls paid by firms involved in direct and indirect sales. Local residents who earn a living working for local direct or indirect-type industries spend a portion of their income to purchase goods and services from local merchants. These local household purchases include such things as groceries, gasoline, medical care, and recreation equipment.

In the Figure 3.29.7 and Figure 3.29.8 below, drivers of the five-county Colorado economy are portrayed. Employment and labor income include jobs and payroll at firms selling to non-residents (exports), governments, capital investments, and local households using outside income. The estimates also include all the indirect and induced effects triggered by these direct sales. Because every job and dollar of labor income in the five-county area can be traced back to direct sales, the total economy is represented.

In recent years, economic driver studies were completed for Archuleta, Dolores, La Plata, and Montezuma Counties (Lloyd Levy Consulting 2008, 2010). In those studies, the direct or basic components of the economy were identified by industry (e.g., mining) or purchaser (e.g., second home owners). In the charts below, the direct or basic components of the economy are identified only by the four driving purchasers of goods and services.

Figure 3.29.7 portrays the jobs generated by each of the four driving purchasers of goods and services in the five-county area. Exports (sales to non-residents) generate the largest share of jobs in each economy. Approximately 40% of all jobs are generated this way. Tourism is a major portion of these jobs. Sales to all levels of government—federal, state, and local—is the second largest driver of the area, generating approximately 37% of all jobs. Education, including both local school districts and Fort Lewis College, is typically the most important share of employment driven by government. Sales to households spending outside income generate 17% of all jobs in the five-county area. Finally, capital investments, like construction of buildings, generate only 6% of the total jobs in the area. Difficulties in acquiring investment funding during the recessionary year of 2010 could account for the modest role of capital improvements.

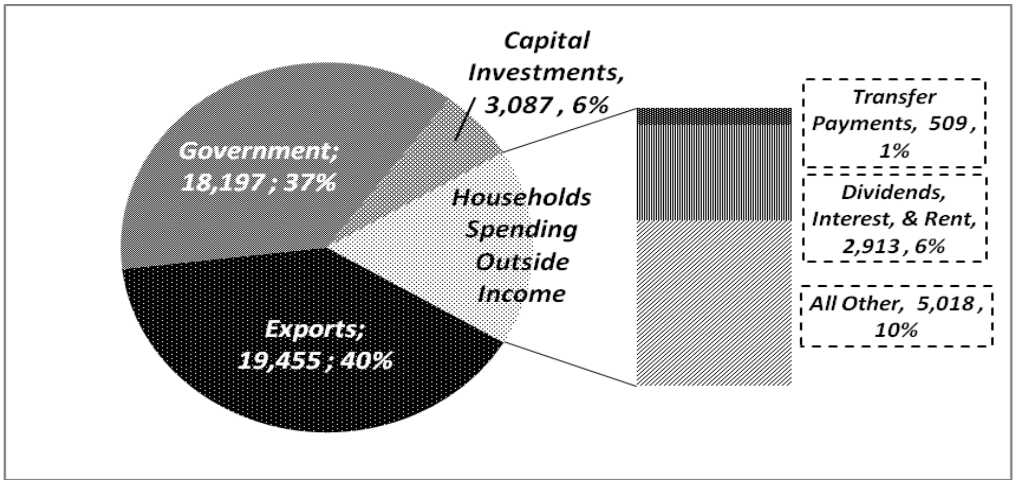


Figure 3.29.7: Employment (jobs) Generated by Spending Source in the Five-county Colorado Area Economy, 2010

Figure 3.29.8 shows the influence of economic drivers on labor income, rather than employment. Labor income includes wages and salaries, benefits, and bonuses received by both employees and business owners of firms doing business in the five-county area. The pie chart is very similar to employment. Generally, sales to government and exports are slightly more important for labor income than employment. Conversely, sales to households spending outside income are less important for labor income compared with employment.

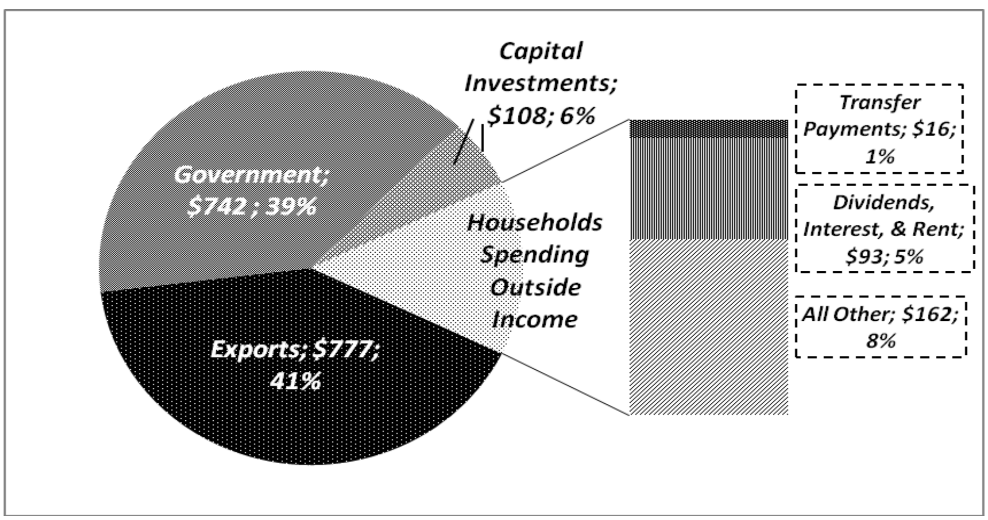


Figure 3.29.8: Labor Income Generated by Spending Source in the Five-County Colorado Area Economy, 2010 ($ million)

Management of the SJNF drives a piece of the five-county economy. Table 3.29.5 and Table 3.29.6 show the jobs and labor income, respectively, that are supported by current land management. The top portion of each table shows the driver by resource program, and the bottom portion translates that by major industry. The export portions of SJNF and TRFO management are primarily grazing, wood products, and mineral production. Government purchases are primarily SJNF and TRFO operations (federal) and spending of federal payments made to local governments attributable to these public lands. The federal payments are discussed in detail in Section 3.31. It is worth noting that local government spending of federal payments generates more jobs in the five-county area than any

resource program, except recreation. From an income standpoint, the minerals program generates more earnings in the area than any other resource activity, except recreation.

The recreation program serves the local economy as both a driver and non-driver of jobs and income. The driving portion of the recreation program is generated by non-local visitors who come to recreate on public land and spend their dollars on such things as lodging, meals, and gasoline. This is the tourism piece of public land recreation. However, locals that receive outside income also spend a portion of their income at local businesses as they recreate on public lands. The expenditures are lower per person than non-locals, but well over a hundred jobs are generated by locals with outside income. As a result of tourists, but also some locals, recreation is by far the most important economic driver among SJNF and TRFO programs for both employment and income.

Table 3.29.5 and Table 3.29.6 also show jobs and income generated locally that are not driver-based. These are jobs and income resulting from spending by locals who earn a paycheck at local businesses. These workers earn a paycheck because their employer is directly or indirectly involved as a driver in the five-county economy. For example, a chocolate manufacturer that exports its products to Denver and local businesses that are part of the manufacturer supply chain employ workers and pay them wages. Workers at both the manufacturer and its local suppliers spend a portion of their wages on gasoline to mountain bike on public lands. Because their spending is already credited to the chocolate manufacturer, they cannot be counted again as a driver. But their spending nonetheless generates employment locally and it is attributable to public land recreation.

Once the related non-driver activity is added to the driver portion of public land recreation, the result is the total contribution of the SJNF and TRFO recreation program. Other programs are analyzed similarly, but only the recreation program of public land management has a sizeable element that is not a driver. The balance of this section focuses on the total contribution of SJNF and TRFO programs. Compared with all jobs in the five-county area, SJNF and TRFO programs account for just over 6% of employment and 5% of labor income.

Table 3.29.5: Total Contribution to Employment (jobs) by San Juan National Forest and Tres Rios Field Office Program and Industry in the Five-county Colorado Area Economy, 2010

Program	Driver	Non-driver	Total Contribution
	$ Million		
Recreation	1,857	147	2,005
Grazing	268	–	268
Wood products	29	–	29
Minerals	278	–	278
Operations	102	–	102
Payments to local governments	379	–	379
Total	**2,913**	**147**	**3,061**
Industry	**Driver**	**Non-driver**	**Total Contribution**
	$ Million		
Agriculture	277	3	280
Mining	145	0	145
Construction	39	0	39
Manufacturing	50	4	54
Transportation and utilities	41	4	45
Trade	340	47	386
Visitor services	1,296	66	1,365
Other services	342	16	358
Government	383	6	389

Total	2,913	147	3,061
Percent of all jobs in five-county area	5.9%	0.3%	6.2%

Table 3.29.6: Total Contribution to Labor Income and Industry in the Five-County Colorado Area Economy, 2010 ($ million)

Program	Driver	Non-driver	Total Contribution
	$ million		
Recreation	$44.8	$4.1	$49.0
Grazing	$1.0	–	$1.1
Wood products	$1.1	–	$1.1
Minerals	$23.2	–	$23.2
Operations	$4.4	–	$4.4
Payments to local governments	$15.8	–	$15.8
Total	**$90.3**	**$4.1**	**$94.6**
Industry	**Driver**	**Non-driver**	**Total Contribution**
	$ million		
Agriculture	$1.1	$0.0	$1.1
Mining	$18.7	$0.0	$18.7
Construction	$1.5	$0.0	$1.5
Manufacturing	$1.5	$0.1	$1.6
Transportation and utilities	$2.1	$0.2	$2.4
Trade	$10.3	$1.5	$11.8
Visitor services	$24.2	$1.2	$25.5
Other services	$12.5	$0.6	$13.1
Government	$18.4	$0.5	$18.9
Total	**$90.3**	**$4.1**	**$94.6**
Percent of all labor income in five-county area	**4.8%**	**0.2%**	**5.0%**

A detailed analysis of economic dependency was not prepared for San Juan County, New Mexico. The focus of its economic relationship to the SJNF and TRFO is limited in this document to connections with natural gas development. This relationship has been documented in *Oil and Gas Economic Impact Analysis*, a recent study prepared by Booz Allen Hamilton (2007) for the Colorado Energy Research Institute.

3.29.3 Environmental Consequences

Economic Impact Analysis

To estimate the economic impacts to the planning area economy, one model covering five counties was developed. The counties included Archuleta, Dolores, La Plata, Montezuma, and San Juan. This area matches both state and local recognition of a functional social and economic planning area. Labor flows between towns and counties are generally contained within these five counties. Interstate flows of labor, goods, and services between this area and San Juan County in New Mexico (Farmington, Bloomfield, and Shiprock) were not captured in the model, but considered as exports or imports along with other parts of the country. A separate model for San Juan County, New Mexico, was created to model oil and gas effects in the Farmington area.

IMPLAN was used to build and run the model. IMPLAN is a software package that uses the latest national input-output tables from the Bureau of Economic Analysis, secondary economic data at the

county level from a variety of sources, and proprietary procedures to develop input-output models for every county or group of counties in the nation. The software was originally developed by the USFS and is now owned by IMPLAN, Inc. The model was calibrated to employment estimates in 2010 using data from the Colorado Department of Local Affairs, State Demography Office. The State Demography Office works closely with counties in the planning area to establish mutually agreed-upon estimates of population, employment, and personal income for current conditions and projections out to 2030. Model calibration was done using output per employee and similar ratios from the IMPLAN dataset with employment estimates from the State Demography Office.

Economic impacts were estimated for the base year 2020 for each alternative. The alternatives were evaluated in year 2020 because the Colorado State Demography Office forecasts are available in 5-year increments, and this year offers sufficient time for implementation of each alternative during the first decade.

Dependency and Contribution Analysis

The IMPLAN model was used to assess the economic dependencies of the planning area. Economic dependency is a way of assessing the strength of regional or local economies. Regional economies generally depend on exports to sustain local income and employment. However, sales to governments, capital investments, and resident households with outside income must also be examined. A measure of reliance upon each aspect of the area economy was estimated and displayed. Dependency on economic activity associated with the SJNF and TRFO was also analyzed. In all cases but recreation, the economic activities are drivers in the economy. Recreation is both a driving and non-driving component of the local economy. Resource outputs and governmental expenditures by the SJNF and TRFO in 2010 were the elements analyzed for both driving and non-driving components.

Economic Impact Analyses

Impact analysis describes what happens when a change in spending for goods and services occurs in the model region. Changes in sales are the result of multiplying production data (e.g., grazing AUMs or recreation visits) times spending by users of public lands. Economic impacts were estimated for 2020 using the best available production and sales data. Baseline prices and data sources of each economic activity are listed in Table 3.29.7 and Table 3.29.8.

Impacts to local economies were measured using two metrics: employment and labor income. Employment is expressed in jobs. A job can be seasonal or year-round, full-time or part-time. Jobs represent the annual average of 12 monthly estimates. There is no seasonality in this measure. The income measure used is labor income expressed in 2010 dollars. Labor income includes both employee compensation (pay plus benefits) and income received by proprietors (self-employed).

Projections of employment and income to 2030 are made by the Colorado State Demography Office. These projections implicitly incorporate some level of land management, and that level is assumed to be Alternative A, or the current management alternative. Whether each alternative would increase, decrease, or not affect the projections is the purpose of the cumulative effects analysis. Projections for 2020 (2025 for the minerals analysis) are used for this analysis. These projections provide a context for understanding alternative impacts. A full description of cumulative effects is provided below.

Data and Assumptions

Oil and Gas

Estimates of well drilling and natural gas production are based on oil and gas potential and RFD scenarios prepared for the planning area. Assumptions include wells that would be drilled in areas of high potential for oil and gas and new wells that would be drilled in areas with current production. Natural gas production on state and private lands over the federal mineral estate is included in the analysis of each alternative, but does not vary by alternative.

Market prices for domestic natural gas and oil were obtained from the DOE, Energy Information Administration. The cost of well drilling by basin was obtained from staff petroleum engineer estimates based on typical drilling conditions. Field development and production estimates were provided by the SJNF and TRFO planning and minerals staff.

Recreation

Data from the NVUM project for the SJNF (2011) are used to estimate recreational use on the SJNF. BLM estimates were provided by the TRFO. Visits estimated by the NVUM project and used in the Draft EIS had been mistakenly overstated, then corrected after publication. New estimates for the FEIS are in line with the corrected visits.

To estimate the economic impact of recreation, it is necessary to first separate local resident visits from other Colorado residents and non-resident (out-of-state) visits. For purposes of this analysis, Colorado residents from outside the five-county area and out-of-state residents are considered as non-locals. Typically, spending by non-locals is substantially higher than locals per visit and therefore must be analyzed separately.

The visitor expenditure profiles used in the analysis were obtained from the NVUM project. Each national forest is classified as a high, average, or low spending area by comparing local spending with national averages. Spending on the SJNF best matched higher than average spending rates. It is assumed that spending by BLM visitors was similar to those visiting the SJNF.

There are several major determinants of recreation visitor spending: 1) downhill skiing versus all other recreation activities, 2) local versus non-local residence, 3) day versus overnight trips, and 4) overnight stays on or off public lands. All of these determinants are factored into the economic impacts of recreation use. All expenditures are adjusted to 2010 dollars to be compatible with the economic models.

Timber Production

Financial values associated with timber harvest from the SJNF were based on a 3-year average, from 2009 to 2011. This is done to account for annual variations in timber harvest from USFS and BLM lands. All timber activity was assumed to involve local logging and processing.

Due to the price fluctuations associated with lumber products, the direct economic activity associated with wood products processing was based on quantities of timber production. Estimates of direct employment and labor income per centrum cubic feet (CCF) were provided by the Bureau of Business and Economic Research, University of Montana (see Table 3.29.7 and Table 3.29.8). Estimates of the total employment associated with timber production from the SJNF were developed using IMPLAN employment multipliers from wood products sectors in the model.

Livestock Grazing

SJNF and TRFO records indicate that there are over 148,000 AUMs of forage use on public lands in the planning area. Ninety-three percent of the total AUMs were cattle grazing and 7% were sheep grazing. Livestock prices were estimated using inventory and marketing data from the National Agricultural Statistics Service for Colorado in 2010.

Operating Budget and Employment

SJNF and TRFO data indicate that the 2010 budget totals for the both the SJNF and TRFO combined is approximately $18 million. The budget supported approximately 250 BLM and USFS employees in the five-county area. About 200 of these workers were permanent employees

Table 3.29.7: Direct Economic Activity Used in Economic Impact Analysis

Activity	Units	Direct Economic Activity ($)
Tourism/Recreation spending[1]		
Downhill skiing		
Non-local day	Party-trip	$69
Non-local overnight	Party-trip	$893
All other recreation		
Local day trip	Party-trip	$30
Non-local overnight (on public lands)	Party-trip	$352
Non-local overnight (off public lands)	Party-trip	$782
Livestock market values[2]		
Cattle	Animal	$1,273
Sheep	Animal	$178
Oil and gas market values[3]		
Natural gas (wellhead)	MMCF	$3.96
Oil and gas well drilling costs[4]		
Dry hole – NSJB	Well	$231,000
Producer – NSJB	Well	$517,000
Dry hole – Paradox/Gothic Basins	Well	$1,384,000
Producer – Paradox/Gothic Basins	Well	$3,099,000
SJNF and TRFO operations[5]		
Budget in 2010	Dollars	$18,135,000
Employment in 2010	Full-time employment	247
Wood products processing[6]		
Logging	Jobs/MMCF	18
Sawmills	Jobs/MMCF	32
Other	Jobs/MMCF	86

1 White and Stynes (2010).
[2] National Agricultural Statistics Service (2011).
[3] U.S. Energy Information Administration (2011).
[4] Thrash and Powers (2007).
[5] Duvall (2012).
[6] Morgan and Keegan (2011).

Financial and Economic Efficiency Analysis

Financial efficiency is defined as how well the dollars invested in each alternative produce revenues to the government. Economic efficiency is defined as how well the dollars invested in each alternative produce benefits to society. Present net value (PNV) is used as an indicator of financial and economic efficiency.

Quick-Silver, a public domain Windows-based program, was used to discount revenues, benefits, and costs over a 50-year period (2013–2063). A 4% discount rate is specified by agency policy and used for these analyses.

Some economic values were based on actual revenues where markets exist. For natural gas and grazing, these values are based on the same sources discussed above for economic impact analysis. For timber, financial values are based on USDA and USFS records for the SJNF from 2009 through 2011. These data are reported by the agency in both the annual Timber Cut and Sold Reports and Periodic Timber Sale Accomplishment Reports (USFS 2009–2012a; USFS 2009–2012b). Values for recreation represent a market-clearing estimate of willingness-to-pay evaluations. These economic values were developed by Bowker et al. (2009). Values are net of fees paid by recreations (e.g., lift tickets, camp fees). As discussed in the FEIS, willingness-to-pay estimates for non-use values such scenery, existence values, or bequest values have not been established by the agency and were therefore excluded from this analysis. All values were adjusted to 2010 dollars. Table 3.29.8 displays the economic values and revenues used for each resource.

Table 3.29.8: Economic Benefits and Financial Revenue Values

Activity	Unit	Economic Benefit ($)	Agency Financial Value ($)
Recreation			
Downhill skiing	Visit	$208.18	N/A
Cross-country skiing	Visit	$208.18	N/A
Snowmobiling	Visit	$127.23	N/A
Hunting	Visit	$76.71	N/A
Fishing	Visit	$98.17	N/A
Viewing scenery/wildlife	Visit	$54.41	N/A
OHV use	Visit	$86.34	N/A
Driving	Visit	$78.56	N/A
Hiking/Biking	Visit	$108.19	N/A
Developed camping	Visit	$46.11	N/A
Primitive camp/backpacking	Visit	$48.30	N/A
Other recreation	Visit	$49.46	N/A
Grazing			
Cattle	HM	N/A	$1.35
Sheep	HM	N/A	$0.27
Permittee costs-cattle	HM	$14.08	N/A
Permittee costs-sheep	HM	$6.24	N/A
Forage	AUM	$12.81	N/A
Timber			
Sawtimber	CCF	N/A	$10.44
Pulpwood	CCF	N/A	$2.73
Poles	CCF	N/A	$6.34
Posts	CCF	N/A	$6.48
Fuelwood	CCF	N/A	$11.41
Non-sawtimber	CCF	N/A	$26.14
Miscellaneous convertible	CCF	N/A	$6.11
Green biomass	CCF	N/A	$1.65
Natural gas			
Wellhead Price	MMCF	$3.96	N/A

Dry hole drilled – NSJB	Well	$231,000	N/A
Producer drilled – NSJB	Well	$517,000	N/A
Dry hole drilled – Paradox/Gothic	Well	$1,384,000	N/A
Producer drilled – Paradox/Gothic	Well	$3,099,000	N/A
Royalties	MMCF	$0.50	N/A
Operations	MMCF	$1.00	N/A
Note: Total budgets for public lands management were held constant and assumed to be fully spent for each alternative. "N/A" has been used for values where the economic benefits and financial values are not equivalent.			

Direct and Indirect Impacts

Direct and indirect impacts on planning area jobs and income are the result of changes in recreational uses of the public lands, mineral development and extraction, the use of timber and forage resources, agency expenditures (including salaries, equipment, contracts), and local government spending of federal payments. A change in recreation, mineral, and/or in timber production may mean a change in jobs and income to local communities. In addition, if production is decreased in one resource and increased in another, there may be a shifting of jobs from one industry to another. To estimate changes in income and employment for each alternative, a computer model of the area economy was developed. The model was calibrated to employment estimates established by the Colorado State Demography Office (2011).

Throughout the planning area, employment and labor income attributable to the planning area are estimated for the year 2020. The year 2020 was selected because it provided both an approximate mid-point of the next decade and is a year for which the Colorado State Demography Office provides detailed forecasts (2012). In addition, 2020 would allow time for changes in program levels to materialize. The base year for all comparisons is 2010 (the latest year for which complete economic data are available). Jobs are defined as annual average jobs, some of which may be part-time. Labor income includes all wages and salaries plus benefits paid by business proprietors to employees and to themselves.

The analysis uses actual outputs of the planning area for 2010 and estimates for 2020. As shown above, there are six programs administered by the SJNF and TRFO that may impact local economies: recreation (including hunting, fishing, and other wildlife-based activities), grazing, wood products, minerals (especially natural gas), administrative expenses, and local government spending of federal payments.

Impacts Related to Recreation

The visitor expenditure profiles used in the analysis were obtained from two sources. Expenditures for local and non-local recreationists were obtained from the NVUM system. NVUM is a statistically reliable national survey of recreation visitors to national forests. Each national forest is classified as a high-, average-, or low-spending area by comparing local spending with national averages. Spending on the SJNF is classified as a high-spending area. NVUM spending patterns were also applied to recreation visitors on BLM lands. Statistically, visitor spending is dependent on whether they 1) are local/non-local, 2) stay overnight, and if so 3) whether they spend the night on or off the public lands. Visitor spending is similar for all public lands recreation activities except downhill skiing. Downhill skiers have markedly higher spending, so they are analyzed separately.

As discussed in the Section 3.14, Recreation, the total number of visitors to the planning area is projected to hold steady over the planning horizon for all of the alternatives. Current recreation

patterns are also expected to hold steady across alternatives. Therefore, the economic effects of recreation are not expected to vary.

Impacts Related to Livestock Grazing

Compared with the current management alternative (Alternative A), livestock grazing production would be generally maintained under Alternative B, would drop by approximately 13% under Alternative C, and would increase by approximately 37% under Alternative D. Some permittees may maintain, or potentially even increase, the number of AUMs, with more intensive management. Some permittees may choose to reduce AUMs (due to market and personal factors that are outside the scope of this analysis).

Impacts Related to Wood Products

Over the last decade, timber industry reliance upon the SJNF has undergone major changes. Because of the dramatic contraction in the national housing industry and reduced supplies from public lands, wood processors in the five-county area have responded in one or more of the following ways: 1) adjusted their source of timber supplies, 2) updated their mills to improve efficiency, 3) changed their product mix, or 4) closed. This analysis assumes that the remaining mills have successfully made adjustments and would continue to operate in the future. The actual economic contribution of the timber program reported in 2010 is just 10% of the timber contribution predicted for 2010 in the 2007 Draft EIS, which used assumptions based on the timber industry conditions and trends of that earlier time

The wood products program is one of two resource outputs that vary by alternative. Under Alternatives A and B, total harvest volume would increase by 40% compared with the 2009–2011 average. Harvest volume would increase by 19% under Alternative C and by 76% under Alternative D. In all cases, the mix of products (e.g., sawtimber, fuelwood, and biomass) would remain unchanged from the 3-year average. It is assumed that local processing capacity would be sufficient to process all volume harvested.

Impacts Related to Oil and Gas Exploration and Development

Natural gas field exploration, development, and production are anticipated to expand greatly over the planning horizon under all alternatives. By 2020, nearly 50 additional producing wells in the NSJB and 40 in the Paradox and Gothic Basins are expected to be drilled and completed annually on public lands. Approximately 50 miles of pipelines and 40 miles of road would be constructed each year. Another 7 to 16 miles of roads would be reclaimed each year. Annual production on public lands is expected to reach between 69 and 71 BCF of natural gas, depending on the alternative. By comparison, 30 producing wells in all basins were drilled in 2010 with total production of 95 BCF per year. Details of anticipated mineral activity are found in the energy and mineral sections of this FEIS (see Sections 3.19–3.21).

Variations driven by resource management concerns are not expected to result in substantial economic differences between the alternatives. Alternatives A and D have the largest number of wells and the highest production levels. Table 3.29.9 shows that by 2020 minerals-based employment in the five-county area would increase by about 470 jobs for Alternatives A and D, and by 450 jobs for Alternatives B and C. It should be noted that while job estimates are reported down to a single job, the reader should look for changes in relative magnitude between alternatives. Thus, the range of 20 jobs between the highest and lowest impact alternatives should not be regarded as substantial. The

No Lease Alternative would result in about 400 additional jobs over 2010 employment levels, or 70 jobs less than either Alternatives A or D in 2020.

Employment in San Juan County, New Mexico, associated with oil and gas activities on the SJNF and TRFO was estimated to be about 475 jobs in 2010 (Table 3.29.10). Under the assumption that most of the specialized work for field development would be done by firms in the Farmington area, oil and gas employment in San Juan County, New Mexico, would more than double base year levels (150% more) by 2020.

Impacts Related to Administrative Expenditures

The total operating budget for managing the SJNF and TRFO would remain constant by alternative. The budget has declined in recent years, but is expected to remain relatively stable, after adjustments for inflation, for the next decade. A sizable natural gas leasing program, however, would offset some budget and staffing reductions anticipated for the future. Permit administration, monitoring, and environmental documentation would require funding and workforce supplements. The jobs shown in Table 3.29.9 are not just federal government positions, but addition jobs created in the five-county Colorado area because of local federal spending.

Impacts Related to Local Government Expenditures of Federal Payments

Federal payments paid to local governments would remain generally constant by alternative in the five-county area. However, payments by the NFS may change from 2010. The 1-year extension of the Secure Rural Schools and Community Self-Determination Act of 2000 expired at the end of 2012. If the act is not extended, payments by the NFS would revert to 25% of annual receipts. Given the uncertainty of this situation, the more conservative 25% payments were used to estimate economic effects. This accounts for the 20-job reduction from 2010 to 2020.

Table 3.29.9 and Table 3.29.10 display likely job changes associated with SJNF and TRFO programs; Table 3.29.11 and Table 3.29.12 display the same results by industry. Industries in the five-county Colorado area most impacted by employment changes (from 2010 to 2020) are likely to be mining, construction, and other services. These sectors would be primarily impacted by changes in natural gas development. Between 2010 and 2020, overall growth in jobs related to the SJNF and TRFO are estimated to vary from a low of approximately 13% (under Alternative C) to a high of approximately 20% (under Alternative D). The No Leasing Alternative would likely result in increases of 230 jobs in the mining and construction sectors combined compared with 2010 levels.

From 2010 through 2020, all employment increases; however, the magnitude of increase varies somewhat by alternative. Differences by alternative are mainly due to changes in the minerals and grazing programs. Most job growth and most of the variation would be attributable to planning area–based natural gas development. Impacts related to natural gas development and extraction would likely be experienced in all counties except San Juan County, Colorado.

In the Farmington area, all action alternatives (A–D) would likely result in about 730 more jobs in 2020 than would be attributable to the SJNF and TRFO minerals programs in 2010. The No Leasing Alternative would likely result in increases of 270 jobs, about one-third of the increase estimated for Alternative A. Regardless of the alternative, about 85% of employment effects in San Juan County, New Mexico, would likely be experienced in the mining, construction, and other services sectors. Estimates for the No Leasing Alternative only consider changes to the SJNF and TRFO minerals program.

Table 3.29.9: Projected Changes in Employment (jobs) for the Five-county Colorado Area in 2020

Program	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	Average Annual Jobs				
Recreation	2,005	2,005	–	–	–
Grazing	268	268	(0)	(35)	85
Wood products	29	41	–	(6)	10
Minerals	278	744	(24)	(26)	12
Payments to state/counties	102	80	(0)	(0)	0
SJNF/TRFO operations	379	379	–	–	–
Total	**3,061**	**3,517**	**(24)**	**(67)**	**107**
Percent (%) change in total jobs from base year	–	**15%**	**14%**	**13%**	**18%**

Table 3.29.10: Projected Changes in Employment (jobs) for San Juan County, New Mexico, Related to the SJNF and TRFO Minerals Programs by Alternative in 2020

Program	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	Average Annual Jobs				
Minerals	475	1,201	(43)	(54)	(3)
Percent (%) change in total jobs from base year	**--**	**153%**	**144%**	**141%**	**152%**

Table 3.29.11: Projected Changes in Employment (jobs) for the Five-county Colorado Area Related to All SJNF and TRFO Programs by Major Industry by Alternative in 2020

Industry	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	Average Annual Jobs				
Agriculture	281	275	(1)	(34)	83
Mining	145	328	(10)	(10)	4
Construction	39	143	(6)	(7)	4
Manufacturing	55	62	(0)	(4)	7
Transportation and utilities	45	50	(0)	(1)	1
Trade	386	434	(2)	(3)	2
Visitor services	1,363	1,389	(1)	(2)	1
Other services	358	457	(4)	(6)	5
Government	389	379	(0)	(0)	0
Total	**3,061**	**3,517**	**(24)**	**(67)**	**107**
Percent (%) change in total jobs from base year	**--**	**15%**	**14%**	**13%**	**18%**

Table 3.29.12: Projected Changes in Employment (jobs) for San Juan County, New Mexico, Related to the SJNF and TRFO Minerals Programs by Major Industry by Alternative in 2020

Industry	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	Average Annual Jobs				
Agriculture	0	0	(0)	(0)	0
Mining	141	330	(11)	(12)	6
Construction	44	149	(8)	(14)	(11)
Manufacturing	0	1	(0)	(0)	(0)
Transportation and utilities	9	22	(1)	(1)	(0)
Trade	41	103	(4)	(5)	(0)
Visitor services	29	73	(3)	(3)	0
Other services	208	515	(16)	(19)	2
Government	3	8	(0)	(0)	0
Total	**475**	**1,201**	**(43)**	**(54)**	**(3)**
Percent (%) change in total jobs from base year	**–**	**153%**	**144%**	**141%**	**152%**

Table 3.29.13 and Table 3.29.14 provide a look at impacts related to labor income—first by program and then by industry. As noted earlier, labor income includes all wages and salaries, plus benefits, for employees and for the self-employed. Labor income is estimated to increase the most for those affected by the minerals program. The mining industry is characterized by both a highly skilled workforce and conditions that warrant premium pay. These factors result in compensation levels that often exceed other local industries. Both the five-county Colorado and the Farmington areas exhibit these features in their economies. The No Leasing Alternative is likely to result in income levels that are about $100 million less than Alternative A for the minerals program in 2020.

Table 3.29.13: Projected Changes in Labor Income ($ million) for the Five-county Colorado Area Related to all SJNF and TRFO Programs by Alternative in 2020

Program	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	$ million				
Recreation	$49.0	$49.0	$0	$0	$0
Grazing	$1.0	$1.0	-$0	-$0.1	$0.3
Wood products	$1.1	$1.6	$0	-$0.2	$0.4
Minerals	$23.2	$57.1	-$1.7	-$1.8	$0.8
Payments to state/counties	$4.4	$3.5	-$0	-$0	$0
SJNF/TRFO operations	$15.8	$15.8	$0	$0	$0
Total	$94.5	$128.0	-$1.7	-$2.1	$1.5
Percent (%) change in total income from base year	**–**	**35%**	**34%**	**33%**	**37%**

Table 3.29.14: Projected Changes in Labor Income ($ million) for San Juan County, New Mexico, Related to the SJNF and TRFO Minerals Programs by Alternative in 2020

Program	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	$ million				
Minerals	$27.0	$67.4	-$2.4	-$2.9	$0
Percent (%) change in total income from base year	–	149%	140%	138%	149%

Changes to labor income by industry are presented in Table 3.29.15 and Table 3.29.16. Mining and construction are the sectors most likely to benefit from any of the alternatives. This demonstrates how the sizable effects of natural gas development and production contribute a dominant share of the impact of all resource programs taken as a whole. Other services are the sectors next most likely to see substantial gains. These sectors benefit the most from potential changes in tourist activity, but they also respond to changes in energy development. Because differences among the action alternatives are small for natural gas development and production, the pattern of industry impacts changes little across Alternatives A through D.

Table 3.29.15: Projected Changes in Labor Income for the Five-county Colorado Area Related to All SJNF and TRFO Programs by Major Industry by Alternative in 2020 ($ million)

Industry	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	$ million				
Agriculture	$1.1	$0.9	-$0.0	-$0.1	$0.2
Mining	$18.7	$42.6	-$1.1	-$1.2	$0.4
Construction	$1.5	$5.4	-$0.2	-$0.3	$0.2
Manufacturing	$1.6	$1.9	$0.0	-$0.2	$0.3
Transportation and utilities	$2.4	$2.7	-$0.0	-$0.0	$0.1
Trade	$11.8	$13.1	-$0.1	-$0.1	$0.1
Visitor services	$25.4	$25.9	-$0.0	-$0.0	$0.0
Other services	$13.1	$17.0	-$0.1	-$0.2	$0.2
Government	$18.9	$18.5	-$0.0	-$0.0	$0.0
Total	$94.5	$128.0	-$1.7	-$2.1	$1.5
Percent (%) change in labor income from base year	**--**	**35%**	**34%**	**33%**	**37%**

Table 3.29.16: Projected changes in labor income for San Juan County, New Mexico related to all SJNF and TRFO programs by major industry by alternative in 2020 ($ million)

Industry	2010	2020	Change from Alternative A in 2020		
	Base Year	Alternative A	Alternative B	Alternative C	Alternative D
	$ million				
Agriculture	$0.0	$0.0	$0.0	$0.0	$0.0
Mining	$12.4	$29.0	-$1.0	-$1.1	$0.5
Construction	$2.2	$7.6	-$0.4	-$0.7	-$0.6
Manufacturing	$0.0	$0.0	-$0.0	-$0.0	$0.0
Transportation and utilities	$0.6	$1.5	-$0.1	-$0.1	-$0.0
Trade	$1.4	$3.5	-$0.1	-$0.1	-$0.0

Visitor services	$0.5	$1.2	-$0.1	-$0.0	$0.0
Other services	$9.7	$24.1	-$0.7	-$0.9	$0.1
Government	$0.2	$0.5	-$0.0	-$0.0	$0.0
Total	$27.0	$67.4	-$2.4	-$2.9	$0.0
Percent (%) change in labor income from base year	–	**149%**	**140%**	**138%**	**149%**

Because of activity under current leases, the No Leasing Alternative may result in labor income increases of $28 million across all industries compared with 2010 levels. Most of the increase would occur in the mining and construction sectors.

In the Farmington area, all action alternatives (A–D) would likely result in about $67 million more in 2020 that were attributable to the SJNF and TRFO minerals programs in 2010. The No Leasing Alternative would likely result in increases of $41 million, about 60% of labor income increases estimated for Alternative A. Regardless of the alternative, about 90% of employment effects in San Juan County, New Mexico, would likely be experienced in the mining, construction, and other services sectors. Estimates for the No Leasing Alternative only consider changes to the SJNF and TRFO minerals programs.

Cumulative Impacts

In the future, social and economic change in the planning area would emerge from the combined actions of many individuals, businesses, governments, and other organizations. A vast number of decisions made by thousands of players over the next decade would affect growth and change in employment, housing, and transportation. For economic impact purposes, it is impossible to account for and project the effect of all such decisions separately. However, standard projections of employment and income that carry forward the economic momentum observed in current conditions and trends are often taken as a measure of how the economy is likely to develop, absent of unforeseen inputs. The cumulative analysis takes this approach by using a generally accepted projection of employment and income to 2020 to account for future levels of economic development, except for the effects of the alternatives themselves.

Projections used in the FEIS were based on estimates generated by the Colorado State Demography Office (2012b). Employment projections for San Juan County, New Mexico, are based on growth rates provided by the New Mexico Department of Workforce Solutions, Economic Research and Analysis Bureau (2012). However, the rates are available only to 2020. Labor income was assumed to increase at the same rate as employment. Table 3.29.17 displays the cumulative effects of all SJNF and TRFO programs.

If projections made by the State of Colorado bear out, the five-county Colorado area would experience healthy growth. Between 2010 and 2020 employment in the five-county Colorado area is projected to grow by 33%. In the Farmington area, total employment is expected to grow about 20% in the same time period. From an income perspective, the five-county Colorado area is projected to see a doubling in labor income from 2010 to 2020. While no projection for income is available for the Farmington area, it is assumed here that labor income would grow at approximately the same rate as employment.

As shown in Table 3.29.17, the public lands contribution to the area is expected to increase in terms of both jobs and income but to not grow as fast. Consequently, the share contributed by the SJNF and TRFO to the area economy is expected to decrease somewhat by 2020. The SJNF and TRFO

share of employment would drop about 1%, and income would drop about 2%. The difference in the magnitude of change among the alternatives is likely to be very small. Durango would potentially experience the most change among all communities in the five-county area because of its size and its role as a regional center. Retirees and late-career households may continue to move to the area as before or perhaps in greater numbers, creating additional service and trade jobs of all types.

Table 3.29.17: Estimated Cumulative Impacts of All SJNF and TRFO Programs on Employment and Labor Income in the Five-county Colorado Area by Alternative for 2020

Economic Indicator	2010		Forecast in 2020				
	Area Totals	SJNF and TRFO Share	Area Totals	SJNF and TRFO Share			
				A	B	C	D
Employment							
Total (jobs)	49,180	3,060	65,564	3,516	3,492	3,449	3,623
Percentage (%) of area total	100%	6.2%	100%	5.4%	5.3%	5.3%	5.5%
Percentage (%) change from Alternative A	–	–	–	–	-0.1%	-1.9%	3.0%
Labor Income							
Total ($ million)	$1,898.6	$94.5	$4,127.8	$128.0	$126.3	$125.9	$129.5
Percentage (%) of area total	100%	5.0%	100%	3.1%	3.1%	3.1%	3.1%
Percentage (%) change from Alternative A	**–**	**–**	**–**	**–**	**-1.3%**	**-1.6%**	**1.2%**

Table 3.29.18 shows SJNF and TRFO-based employment shares of total area employment for the minerals program only. This table shows that employment associated with SJNF and TRFO minerals would grow increasingly important in the five-county area. Shares that were only 0.6% in 2010 are estimated to become approximately 1.1% in 2020 and about 2% in 2025.

Table 3.29.18: Estimated Cumulative Impacts of the SJNF and TRFO Minerals Programs on Employment in the Five-county Colorado Area by Alternative for Selected Years

Indicator	2010		Forecast in 2020				
	Area Totals	SJNF and TRFO Share	Area Totals	SJNF and TRFO Share			
				A	B	C	D
Total (jobs)	49,180	278	65,564	744	721	718	756
Percentage (%) of area total	100%	0.6%	100%	1.1%	1.1%	1.1%	1.2%
Percentage (%) change from Alternative A	**–**	**–**	**–**	**–**	**-3.1%**	**-3.5%**	**1.6%**
Indicator	**2010**		**Forecast in 2025**				
	Area Totals	**SJNF and TRFO Share**	**Area Totals**	**SJNF and TRFO Share**			
				A	**B**	**C**	**D**
Total (jobs)	49,180	278	72,926	1,507	1,418	1,425	1,498
Percentage (%) of area total	100%	0.6%	100%	2.1%	1.9%	2.0%	2.1%
Percentage (%) change from Alternative A	**–**	**–**	**–**	**–**	**-5.9%**	**-5.4%**	**-0.6%**

Table 3.29.19 shows the same pattern for labor income shares in the five-county area. Shares of labor income associated with SJNF and TRFO minerals that were 1.2% in 2010 are estimated to increase to 1.4% in 2020 and 2.2% in 2025. The income share from SJNF and TRFO minerals shows a slower growth rate than employment. This is because total labor income is projected to grow faster than employment in the five-county area over the next 7 years.

Table 3.29.19: Estimated Cumulative Impacts of the SJNF and TRFO Minerals Programs on Labor Income in the Five-county Colorado Area by Alternative for Selected Years

Indicator	2010		Forecast in 2020				
	Area Totals	SJNF and TRFO Share	Area Totals	SJNF and TRFO Share			
				A	B	C	D
Total ($ million)	$1,898.6	$23.2	$4,127.8	$57.2	$55.5	$55.4	$57.9
Percentage (%) of area total	100%	1.2%	100%	1.4%	1.3%	1.3%	1.4%
Percentage (%) change from Alternative A	–	–	–	–	**-3.0%**	**-3.1%**	**1.2%**
Indicator	**2010**		**Forecast in 2025**				
	Area Totals	**SJNF and TRFO Share**	**Area Totals**	**SJNF and TRFO Share**			
				A	**B**	**C**	**D**
Total ($ million)	$1,898.6	$23.2	$5,345.4	$119.3	$112.6	$113.6	$118.3
Percentage (%) of area total	100%	1.2%	100%	2.2%	2.1%	2.1%	2.2%
Percentage (%) change from Alternative A	–	–	–	–	**-5.6%**	**-4.8%**	**-0.8%**

Table 3.29.20 compares employment and income generated from SJNF and TRFO minerals with total employment and income in San Juan County, New Mexico. Projections for this area are only available for employment to 2020. Labor income in 2020 has been projected using the same rate of growth as employment. Employment shares are estimated to increase from 0.8% of total area employment in 2010 to 1.6% in 2020.

Table 3.29.21 labor income generated by SJNF and TRFO minerals is expected to grow from 1.0% in 2010 to 2% in 2020. If these activity projections materialize, job growth estimated for SJNF and TRFO minerals would grow substantially faster than total area job growth between 2010 and 2020.

Table 3.29.20: Estimated Cumulative Impacts of the SJNF and TRFO Minerals Programs on Employment in San Juan County, New Mexico, by Alternative for Selected Years

Indicator	2010		Forecast in 2020				
	Area Totals	SJNF and TRFO Share	Area Totals	SJNF and TRFO Share			
				A	B	C	D
Total (jobs)	61,030	475	74,701	1,201	1,158	1,147	1,198
Percentage (%) of area total	100%	0.8%	100%	1.6%	1.6%	1.5%	1.6%
Percentage (%) change from Alternative A	–	–	–	–	**-3.5%**	**-4.5%**	**-0.2%**

Indicator	2010		Forecast in 2025				
	Area Totals	SJNF and TRFO Share	Area Totals	SJNF and TRFO Share			
				A	B	C	D
Total (jobs)	61,030	475	n/a	2,338	2,180	2,191	2,284
Percentage (%) of area total	100%	0.8%	–	–	–	–	–
Percentage (%) change from Alternative A	–	–	–	–	**-6.8%**	**-6.3%**	**-2.3%**

Table 3.29.21: Estimated Cumulative Impacts of the SJNF and TRFO Minerals Programs on Labor Income in San Juan County, New Mexico, by Alternative for Selected Years

Indicator	2010		Forecast in 2020				
	Area Totals	SJNF and TRFO Share	Area Totals	SJNF and TRFO Share			
				A	B	C	D
Total ($ million)	$2,836.4	$27.0	$3,389.7	$67.4	$65.0	$64.4	$67.4
Percentage (%) of area total	100%	1.0%	100%	2.0%	1.9%	1.9%	2.0%
Percentage (%) change from Alternative A	–	–	–	–	**-3.6%**	**-4.4%**	**0.0%**
Indicator	**2010**		**Forecast in 2025**				
	Area Totals	**SJNF and TRFO Share**	**Area Totals**	**SJNF and TRFO Share**			
				A	**B**	**C**	**D**
Total ($ million)	$2,836.4	$27.0	(not available)	$135.1	$126.0	$127.1	$132.2
Percentage (%) of area total	100%	1.0%	–	–	–	–	–
Percentage (%) change from Alternative A	–	–	–	–	**-6.7%**	**-5.9%**	**-2.1%**

Summary

The size of anticipated natural gas development and production for all action alternatives (A–D) dominates the economic effects. Because the alternatives have small differences in field development and production levels, the difference in economic effects is likewise small. Jobs across all sectors in the five-county Colorado area that are associated with natural gas are expected to more than double, going from about 280 jobs in 2010 to over 710 in 2020. Because earnings associated with energy development would affect a variety of sectors, some with high wages and others with very modest wages, total labor income would increase somewhat less than jobs. With healthy growth projected for southwest Colorado in the years to come, the share of all jobs related to SJNF and TRFO resource management would decrease somewhat by 2020. However, job growth related to energy activity on the SJNF and TRFO is expected to grow at a 13% annual rate between 2010 and 2025.

The Farmington area can also expect substantial job growth related to natural gas development and projection on the SJNF and TRFO. The increase is nearly identical for all action alternatives. Employment and income generated by this activity would increase fourfold, rising from 475 jobs in 2010 to about 1,200 in 2020. Labor income would increase from $27 million in 2010 to $65 million in 2020. This growth is anticipated to be faster than total job growth projected for the Farmington area.

From 2010 to 2025, jobs and labor income related to SJNF and TRFO energy activity are expected to grow at an 11% annual rate.

Financial/Economic Efficiency

Both financial and economic efficiency are analyzed in this section. Financial efficiency examines revenue and cost implications from the perspective of the government agency. (It could also be said that this is the perspective of the taxpayer.) Only those revenues and costs that are recorded in financial records are included in this analysis.

Economic efficiency examines a broader definition of benefits by including values for public land uses that are not captured in the marketplace. Willingness-to-pay values for recreation use are the primary additions over a financial analysis. Estimated market value for meat gained by grazing livestock on public land is also included.

Many non-market, non-use values are excluded from this economic efficiency analysis. Some outcomes or impacts—including those related to biological diversity, wildlife habitat, ecosystem function, water quality, climate change, visual amenities, bequest values, and existence values—have no monetary values or costs that have been established by the USFS or BLM. Academic research studies have explored the monetary expression of such values and preferences in a variety of physical and social settings. However, it is also reasonable and consistent with the Council on Environmental Quality regulations (40 CFR 1502.23) to handle these items in a non-monetary fashion, as is done in other sections of this FEIS. The agency cost of achieving these non-monetary outputs is included in both the economic and financial analyses.

Net public benefit is an important concept for carrying out an LRMP revision. Net public benefit is defined as the overall value to the nation of all outputs and positive impacts (benefits), minus all the associated inputs and adverse impacts (costs) for producing those primary benefits, whether they can be quantitatively valued or not. Conceptually, net public benefits are the sum of this economic analysis, plus the net value of non-priced outputs and costs. It is not the result of an economic analysis alone. This concept is the basis upon which the decision-maker selects an alternative for implementation.

The main criterion used in assessing financial or economic efficiency is PNV. PNV is defined as the value of discounted revenues or benefits, respectively, minus discounted costs. An economic efficiency analysis includes all outputs (timber, grazing, minerals, and recreation) for which monetary values are assigned. As noted above, the monetary values include both market and non-market values received by the public.

In addition, a financial efficiency analysis was completed in order to determine the net financial returns of each alternative. A financial efficiency analysis is the PNV of agency revenues and costs. The following table displays the economic and financial PNV for each alternative. All monetary values are expressed in constant dollars (no allowance for inflation). A 4% discount rate was used over a 50-year period (2013 to 2063). Federal revenues are reduced for payments made to States and/or counties. The reduction of PNV under any alternative, as compared to the highest present net value, is the economic trade-off (or opportunity cost) of achieving that alternative.

As shown in Table 3.29.22, the present value of financial net revenues (public lands revenues minus public lands costs) may vary from a low of $486 million under Alternative B, to a high of $513 million under Alternative A. In all cases, public lands revenues would exceed costs. High natural gas extraction levels would cause Alternative A to exhibit the highest financial net revenues. Alternatives

with a preservation emphasis, such as Alternative C, show lower net revenues to the taxpayer. This is because there are lower agency revenues associated with these emphases in order to offset similar levels of expense. The No Leasing Alternative, which only includes oil and gas production without new leases and no other resource outputs or management, has financial net revenues of $683 million. Only the variable cost of managing the SJNF and TRFO oil and gas programs is included in this estimate, while all government revenues from oil and gas are counted.

Table 3.29.22: Economic and Financial Efficiency by Alternative ($ million)

Indicator	Alternative A	Alternative B	Alternative C	Alternative D
	$ million			
Financial net revenues	$513	$486	$493	$508
Economic net benefits	$7,428	$7,381	$7,399	$7,418
Difference from highest economic net benefit	–	-$47	-$29	-$10

The economic net benefits (society benefits minus all costs) may range from a low of $7.38 billion under Alternative B, to a high of $7.43 billion under Alternative A. The net economic benefits are larger than net financial revenues primarily because the market value of natural gas greatly exceeds federal royalties and more than offsets the cost of natural gas drilling and extraction. The total net value of natural gas production would not vary greatly between alternatives. This suggests that even with the limited monetary values available for this analysis, society would benefit greatly from the implementation of any of the full alternatives considered in this document. The economic net benefits of the No Leasing Alternative are $5.05 billion.

3.30 Demographics

3.30.1 Introduction

This section first presents a snapshot of demographic conditions and trends in the five counties most substantially within the SJNF and TRFO: Archuleta, Dolores, La Plata, Montezuma, and San Juan Counties, Colorado (referred to in this section as the analysis area). The section concludes with discussion of the impacts to population potentially occurring under the range of alternatives for the LRMP. The economic activity levels presented in Section 3.29, Economics, drive the impacts to population discussed here.

Legal and Administrative Framework

- **EO 12898:** This Presidential order requires every federal agency to comply by “identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” The purpose of the assessment is to address the environmental justice of federal actions.

3.30.2 Affected Environment

Existing Conditions and Trends

The West has been in a measurable growth cycle since before the U.S. Census Bureau began keeping tabs on demographics. Figure 3.30.1 shows how the West’s share of U.S. population has grown steadily decade over decade for more than 150 years.

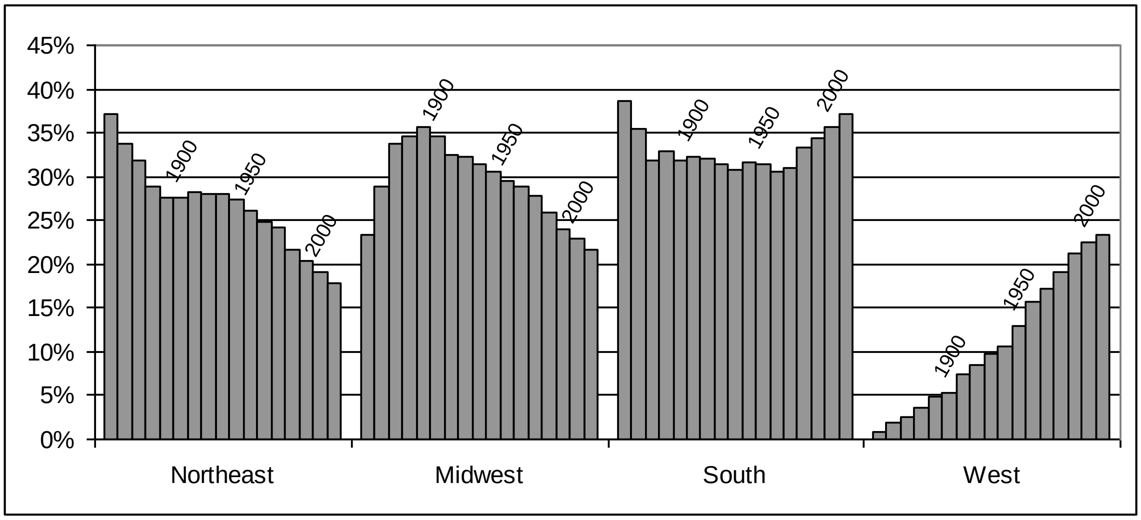


Figure 3.30.1: U.S. Regions Share of Total Population through 2010 (Source: U.S. Census Bureau 2002a, 2002b, 2010b)

In the 20 years from 1990 to 2010, population in the analysis area grew to from 58,550 to 91,716 (57%), compared to 53% for Colorado as a whole. The Colorado State Demographer's Office forecasts that population in the area would grow another 73% to 158,455 in 2040 from 2010 (Figure 3.30.2) compared to 57% forecasted for Colorado as a whole. This reflects an assessment that the analysis area would sustain a relatively high growth rate.

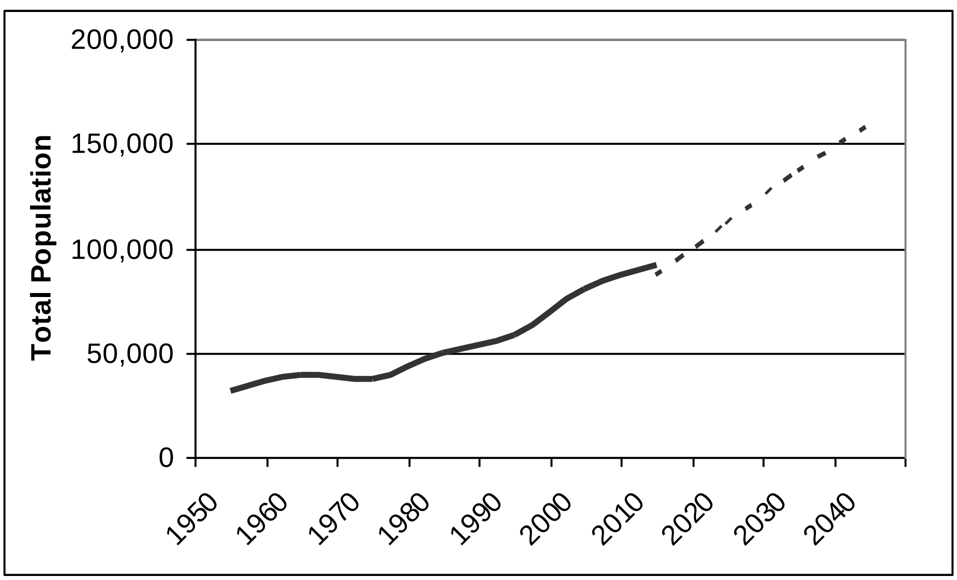


Figure 3.30.2: Total Historical and Forecasted Population of the Analysis Area (Source Colorado State Demography Office 2012a, 2012b)

A comparison of the age structure of the five-county analysis area in 2010 to the age structure of the nation as a whole (Figure 3.30.3) depicts a "top-heavy" population in the analysis area. The younger age groups—under 19 years old and from 20 to 44 years old—are under-represented. Persons in the middle age to pre-retirement cohort (45–64 years old), persons of retirement age (65 to 85 years old), and the elderly (over 85 years old) are over-represented. The lower proportion of youth and early

working age persons in the analysis area indicates that the area's population growth is dominated by a migration of older people into the area and is not primarily due to natural increase (i.e., to a surplus of births over deaths).

The age structure of the population also supports the common observation that large fractions of the population moving into the area are baby boomers (born from 1946 to 1964) and older generations. Another statistic that supports this observation is the rise in non-labor income (such as dividends and interest from financial assets and distributions from retirement accounts) as a contributor to personal income in the analysis area. This is consistent with retirees or near-retirement age people moving to the analysis area, bringing their accumulated wealth and channeling the income into the community through asset purchases and personal consumption expenditures (see Section 3.29, Economics, for details on the income structure within the planning area.)

Many of the same attributes that attract people to visit the mountains, mesas, canyons, and communities of the analysis area also prompt some to take up residence or to buy a second home. As portrayed in Figure 3.30.4, positive net migration (migration in, minus migration out) since 1989 has contributed about 20,000 persons to the population of the analysis area through 2010, with peaks of 2,000 net in-migrants per year occurring in 1995 and 2000. Since 2000, net migration has slowed to around 500 net in-migrants per year but is still a driver of population growth.

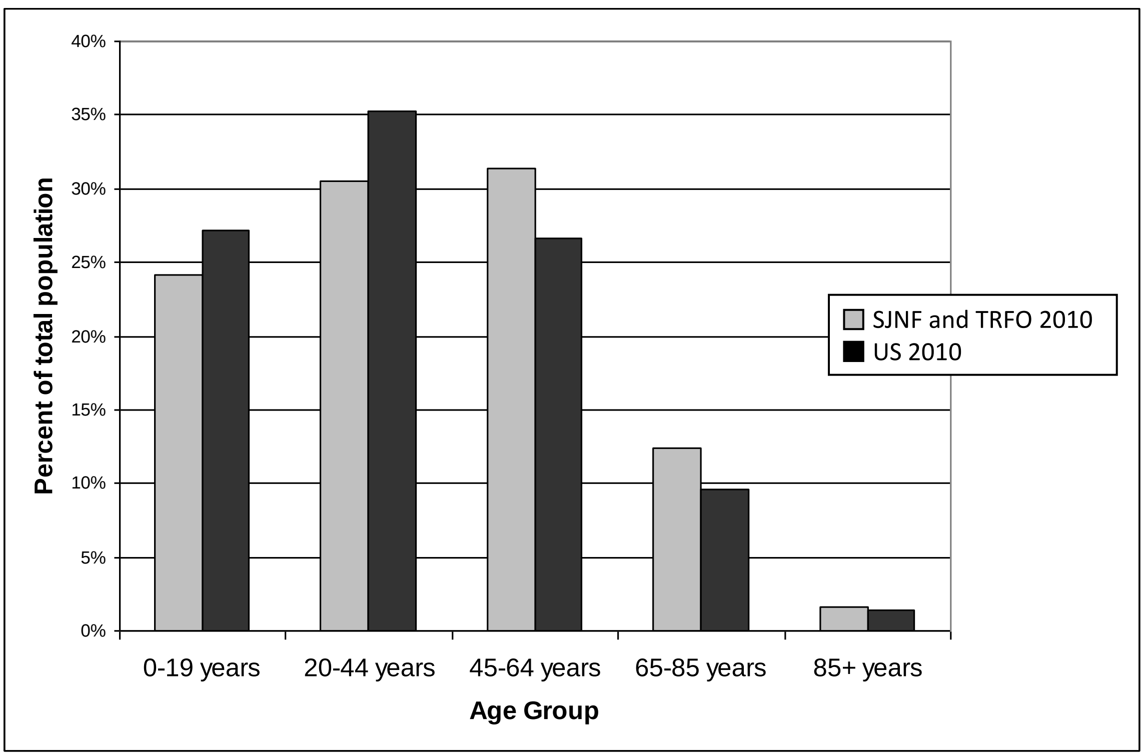


Figure 3.30.3: Age Structure of the Analysis Area Compared to the United States in 2010 (Source: U.S. Census Bureau 2010c)

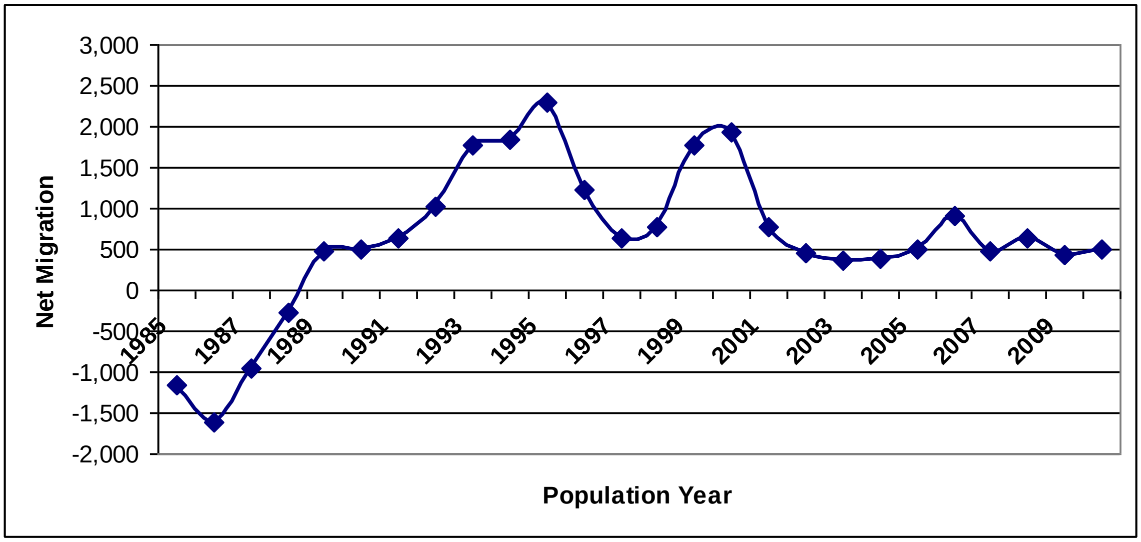


Figure 3.30.4: Net Migration, 1985–2005 (Source: Colorado State Demography Office 2012c)

As net in-migration has slowed, the proportion of residents of the analysis area who have lived in the area at least 5 years has grown. In both 1990 and 2000, nearly one of three residents in the analysis area had reported moving into the county within the previous 5 years, with about one in five moving in from another state. In 2010, as shown in Figure 3.30.5, the U.S. Census Bureau's American Community Survey estimated that 8% of the population had moved into the area in the past 5 years from other counties, states, or foreign countries. Thus, people are moving into the analysis area in lower numbers than before 2000, and "newcomers" are a smaller share of the analysis area population in 2010 than they were in 2000.

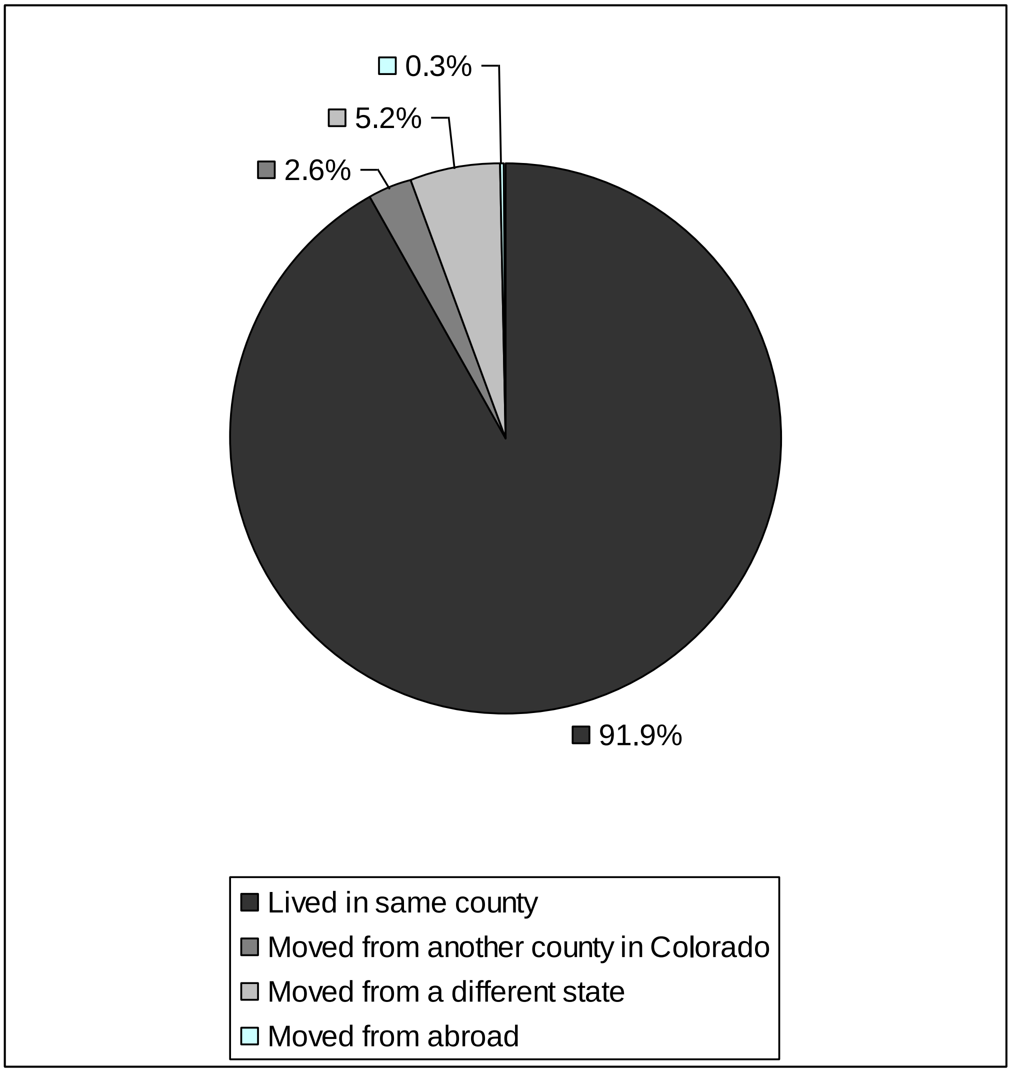


Figure 3.30.5: In-migrants as a Share of the Population in the Analysis Area (Source: U.S. Census Bureau 2010d)

In 2000, largely due to the continued efforts of the Colorado State Demography Office, the U.S. Census Bureau began counting seasonal and second homes. In 2000, about one in six housing units in the analysis area was classified as “seasonal” or “recreational” residences. Now, data from the 2010 Census show that seasonal and second homes are about 13% of all housing units, a lower but still substantial share of the housing stock (Figure 3.30.6).

Figure 3.30.6 also depicts the owners-versus-renters dimension of housing occupancy. The data in the figure from the 2010 Census show that 57% of all housing units are owner occupied and 23% are renter occupied. When considering just occupied housing units, the split was roughly 70% owners and 30% renters in 2010.

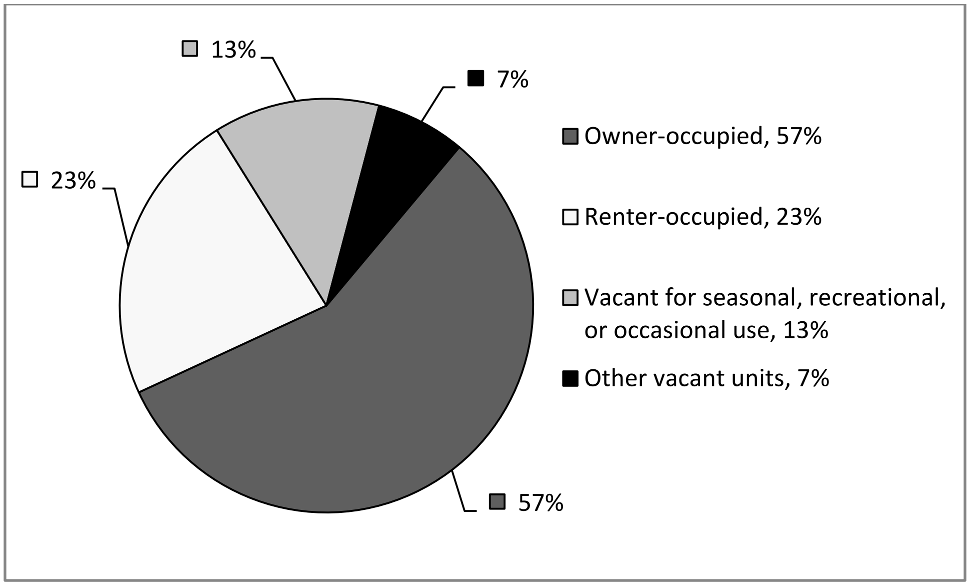


Figure 3.30.6: Occupancy Status of Housing Units in the Analysis Area (Source: U.S. Census Bureau 2010c)

Environmental Justice

A specific consideration of equity and fairness in resource decision-making is encompassed in the concept of environmental justice and civil rights. As required by EO 12898, all federal actions must consider potentially disproportionate adverse effects on minority and low-income communities. Principles for considering environmental justice are outlined in environmental justice guidance under NEPA. Those principles are recognized and have been considered in this analysis.

The data in Table 3.30.1 show that four of five counties in the analysis area have higher proportions of American Indian persons in the population than the state of Colorado as a whole, and in two counties the percentage of American Indian persons is many times that of the state as a whole. American Indian persons are almost 6% of the population in La Plata County, where the Southern Ute Indian Reservation is found, and 12% of the population in Montezuma County, locus of the Ute Mountain Ute Indian Reservation. In Colorado as a whole, American Indian persons are about 1% of the population. Outreach to tribes, in recognition of their special status under EO 12898 and other statutes, regulations, and orders, is discussed later in this section.

Table 3.30.1: Percent of Population by Race in 2010 for Colorado and Counties in the Analysis Area

Colorado/County	White	American Indian	Black	Asian-Pacific Islander	Multi-Race
Colorado	81.3%	1.1%	4.0%	2.9%	10.7%
Archuleta	86.4%	1.9%	0.3%	0.7%	10.7%
Dolores	93.0%	2.9%	0.2%	0.2%	3.7%
La Plata	86.6%	5.8%	0.4%	0.7%	6.5%
Montezuma	81.1%	12.2%	0.2%	0.6%	5.9%
San Juan	92.6%	0.3%	–	1.1%	6.0%
Source: U.S. Census Bureau (2010c).					

Table 3.30.2 shows that Hispanic persons are a large minority in four of five counties in the analysis area: Archuleta County (17.8%), San Juan County (12.0 %), La Plata County (11.8%), and

Montezuma County (11%). However, the percentage of Hispanic persons in these counties is lower than for Colorado as a whole, where Hispanic persons are 20.7% of the population.

Table 3.30.2: Percent of Population by Hispanic Ethnicity in 2010 for Colorado and Counties in the Analysis Area

Colorado/County	Non-Hispanic	Hispanic
Colorado	79.3%	20.7%
Archuleta	82.2%	17.8%
Dolores	96.0%	4.0%
La Plata	88.2%	11.8%
Montezuma	89.0%	11.0%
San Juan	88.0%	12.0%
Source: U.S. Census Bureau (2010c).		

American Indians have a relationship with the land that started long before the SJNF and TRFO were established. Because of this relationship and their standing as sovereign nations, the 25 Native American tribes and pueblos that claim cultural affiliation with lands within the SJNF and TRFO were contacted about the LRMP revision efforts and were offered visits from USFS and BLM managers to gather input and provide further information about the LRMP revision. Please see Chapter 4 of this FEIS for a list of tribes with which the SJNF and TRFO have consulted and a summary of consultation activities.

As of publication of this FEIS, SJNF and TRFO managers have met with representatives of the Jicarilla Tribe, Ute Mountain Ute Tribe, the Hopi Tribe, the Pueblo of Jemez, the Pueblo of Laguna, the Pueblo of Nambe, the Pueblo of Santa Ana, the Pueblo of Santa Clara, and the Navajo Nation. The two tribes with adjacency to the planning area, the Southern Ute Indian Tribe and the Ute Mountain Ute Tribe, have also participated in the Governmental Water Roundtable dealing with revision of the LRMP. All 25 tribes and pueblos are on the LRMP revision mailing list and would continue to receive meeting and draft document notifications, as well as government-to-government consultation meetings with SJNF and TRFO managers as requested.

The Ute Mountain Ute and the Southern Ute Indian Tribes are both major contributors to the area economy and are among the largest employers in Montezuma and La Plata Counties, respectively. Both tribes have diversified economies, including gaming, oil and gas development, and natural resource development on tribal lands. The Southern Ute Indian Tribe also plays a major role in land and housing development in La Plata County.

EO 12898 on environmental justice also pertains to low-income communities. Table 3.30.3 shows the percentage of families in each county below the poverty line in 2010.

Table 3.30.3: Estimated Poverty Rates in 2010

Colorado/County	Percentage	Margin of Error
Colorado	8.6%	+/-0.2
Archuleta	4.7%	+/-2.2
Dolores	10.7%	+/-6.3
La Plata	5.7%	+/-1.3
Montezuma	14.2%	+/-3.3
San Juan	12.2%	+/-7.1

Colorado/County	Percentage	Margin of Error
Data for Archuleta, Dolores, La Plata, and Montezuma Counties are estimated percentages of families in poverty. San Juan County is an estimated percentage of persons in poverty. Source: U.S. Census Bureau (2010e).		

There was some reduction in poverty from 1990 to 2000 because of in-migrants bringing new wealth into the communities in the analysis area, investing in housing, and stimulating the construction industry. However, the rate of in-migration fell after 2000, and the recession and financial crisis of 2007 to 2009 harmed the entire U.S. economy and slowed housing construction and lowered tourism in the analysis area. Thus, as the economy slid back and has only slowly recovered the poverty rates in 2010 are not very different from 2000. Note that the percentages in Table 3.30.3 are survey-based estimates and have large margins of error in most counties because of small sample sizes.

Existing Conditions and Trends Summary

It is clear that population growth remains likely for the analysis area in the future. With a net migration of about 20,000 new residents between 1990 and 2010 and a total population growth of more than 33,000 people over that period, migration is evidently the primary agent of population growth. Given the age structure of the analysis area in 2010, baby boomers and older generations appear to be the larger part of this migration.

Second homeowners are not counted as resident population in a federal Census. However, the U.S. Census Bureau reported in 2010 that 13 housing units in 100 in the analysis area were vacant for seasonal, recreational, or occasional use. Therefore, second homeowners are a considerable presence and are certainly a large contributor to the socioeconomic character of the analysis area.

New residents of all kinds bring productive capacity and wealth to an area. In-migration and the investments by second homeowners contributed to an obvious appearance of more prosperity in 2000 with fewer households living below the poverty line than in 1990. The recession and financial crisis that happened from 2007 to 2009 reversed some of the momentum and prevented some counties of the analysis from showing economic improvement in 2010 compared to 2000.

However, the potential evidenced by the attractiveness of the analysis area in the past remains a fact, and the potential for a resumption of growth when conditions permit is reflected in the most recent State Demographer’s population forecast of an increase of more than 70% in the area’s population by 2040.

Reasons for Migration: Push-Pull Factors

Demographers analyze causes of migration in terms of push factors (a force that acts to drive people away from a specific place) and/or pull factors (what draws people to a new location).

A multitude of factors influence an individual’s or household’s decision to relocate a primary residence. Wealth, mobility, and communication technology make for an increasingly foot-loose population willing, and able, to move to new places. Adverse conditions in certain regions (including smog, traffic, and school violence) may prompt people to move. For some who choose southwest Colorado as a new place of residence, the idea of fishing everyday may be the main reason for their choice. For other people, it may be a job opportunity or a desire to be near family who already live in the area. The migration into the area is the result of many different decisions by many people and conditions in places that are thousands of miles away.

Availability of Jobs

Often, the most substantial pull factors are job opportunities. Demographers have long established that where jobs are created, people would follow. In fact, the Colorado Demography Office population projections are derived in part from job forecasts. In virtually every Colorado region that has experienced population growth approaching that witnessed in southwest Colorado, there has also been a similar increase in jobs.

Unemployment rates are an indicator of job availability when population and the labor force are growing. The recent unemployment trend indicates continued job availability in the larger counties of the analysis area, especially La Plata County where the unemployment rate was lower than state and national levels in 2010. Dolores and San Juan Counties typically have higher unemployment rates than the rest of the region, in part because of a narrow economic base.

Amenities – Perceived Quality of Life

The availability of jobs, however, is not the only pull factor at work in southwest Colorado. Natural amenities and perceived quality of life attract prospective workers, entrepreneurs, and traditional and early retirees.

In a 2006 survey, the Region 9 Economic Development District of Southwest Colorado (which represents the counties of the analysis area) asked residents and second homeowners about their attraction to the region. Residents were asked why they purchased a residence in the area. The top four reasons—cited by from 50% to 71% of the 154 residents that responded—were small town atmosphere, scenery/surroundings, climate, and recreational amenities. Twenty-five percent said it was employment opportunities. Figure 3.30.7 illustrates this comparison.

The same survey in 2006 asked second homeowners why they bought their properties. The top four reasons—cited by 11% to 14% of the 299 second homeowners that responded—were scenery/surroundings, recreational amenities, small town atmosphere, and intent to vacation in the region for years. Six percent said it was investment potential. The comparison is illustrated in Figure 3.30.8. These data suggest that amenities that are not directly bought and sold anchor the pull factors that affect migration and help to drive the market for investment in residential structures in the analysis area.

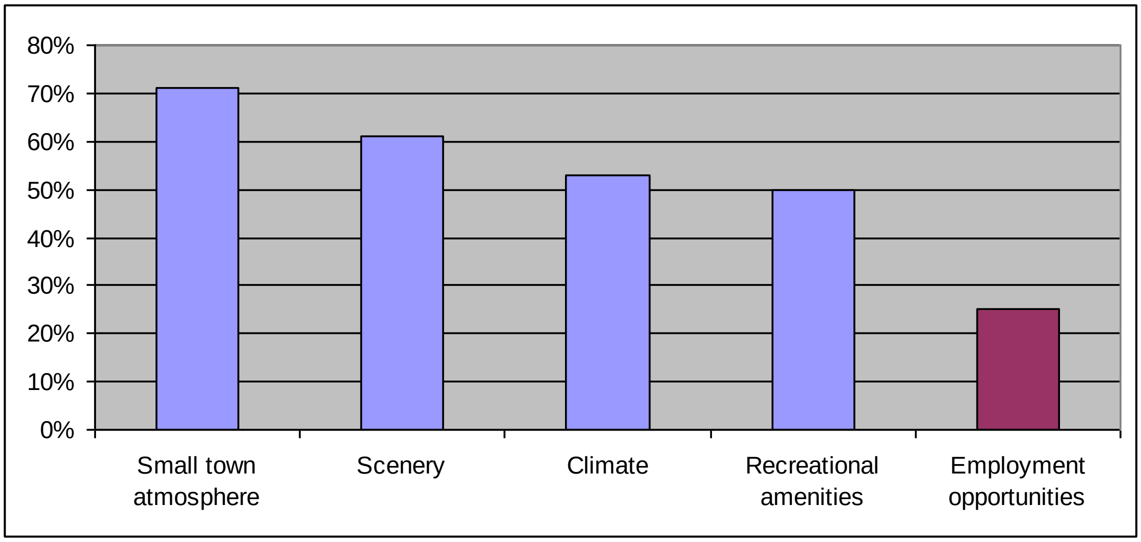


Figure 3.30.7: Region 9 Resident Homeowner Survey in 2006: "Why did you purchase a home in this area?"—top four reasons vs. employment (Source: Region 9 Economic Development District of Southwest Colorado 2006)

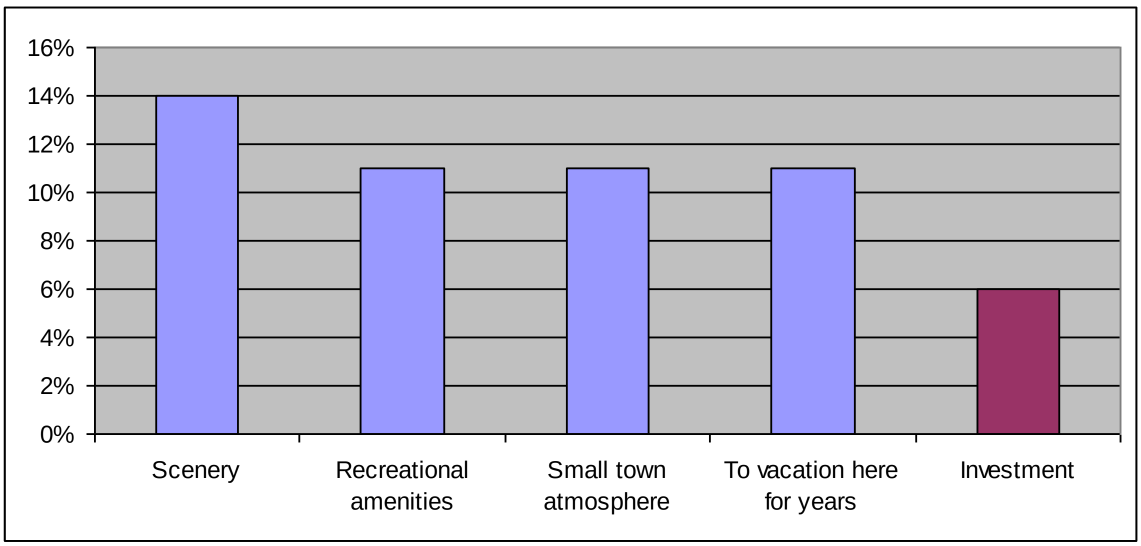


Figure 3.30.8: Region 9 Second Homeowner Survey in 2006: "Why did you buy this property?"—top four reasons vs. investment (Source: Region 9 Economic Development District of Southwest Colorado 2006)

3.30.3 Environmental Consequences

Direct and Indirect Impacts

The affected environment description identified two migration pull factors: 1) the availability of jobs and 2) amenities (perceived quality of life). These facts are important to the migration currently underway. The purpose of the remainder of this analysis is to determine whether demographic trends would be impacted by the alternatives.

Impacts Related to the Availability of Jobs

The Colorado Demography Office commonly points out that population trends often follow economic trends. People in search of jobs move into an area as jobs are created. A slight variation on this would be when a household wanted to relocate for other reasons (including amenities or family), and the employment opportunity would make such a move possible.

The description of the Affected Environment in Section 3.29, Economics, suggests that there are no known events outside SJNF and TRFO management activities that would cause an abrupt change in the current trajectory of area population trends. Therefore, impacts to population from SJNF and TRFO management would occur almost entirely from changes to oil and gas development under the alternatives.

The number of new jobs created because of change to SJNF and TRFO activities under the alternatives would potentially range from 389 jobs under Alternative C to 563 jobs under Alternative D (Table 3.29.9). Almost all the new jobs created under the various alternatives come from potential new development under the SJNF and TRFO oil and gas programs. The No Leasing Alternative would result in even fewer jobs.

The jobs created because of oil and gas development would be expected to stimulate in-migration, some as individuals and others as households. Using a population-to-jobs ratio of about 1.9 in 2010 as a factor, the analysis area could see from 725 to 1,050 persons added to the population by 2020 under the alternatives. This equates to average in-migration of 90 or more persons per year over the 8 years from 2012 through 2020 and, perhaps, demand for 45 housing units a year or more (assuming 1.9 persons per household).

Compared to past numbers of net in-migrants, the arrival of 90 new persons (net) per year in the analysis area equates to an increase of 18% over the flow of approximately 500 net in-migrants per year observed since 2000 (see Figure 3.30.4). On its own, the impact to net migration would be noticeable but would not cause the flow of new arrivals to the analysis area to approach the peaks seen in 1993 to 1995 or 1999 and 2000.

The cumulative population rise by 2020 of 725 to 1,050 persons would be an increase of less than 1% over the current forecast for the analysis area as a whole (see Figure 3.30.2). Because of where new well drilling would occur under the alternatives, all counties of the analysis area could see some population change, with the exception perhaps of San Juan County. However, the population impact would likely be heavily concentrated in La Plata and Montezuma Counties.

Impacts Related to Amenities and Perceived Quality of Life – Recreation and Travel Management

Of central importance, in relation to recreation, are two planning tools: SRMAs and recreation prescriptions in the form of the ROS. SRMAs have specific management guidance because these areas demand attention (due to their identified recreation markets, location, special resources, and high public demand). SRMAs are areas that, due to high demand or to the vulnerability of sensitive resources, need focused dedication of management resources and capital investment.

ROS prescriptions offer a framework in which to establish diverse settings for recreation, with an eye towards diverse access, remoteness, naturalness, proximity to built structures, and other setting characteristics. In essence, these recreation planning tools were introduced into the planning process

in order to continue to diversify recreational opportunities and meet future demand for recreation in a prioritized manner, as necessitated by tangible fiscal limits.

The general policies and desired conditions all aim to provide existing, and future, recreational opportunities and demand. In this respect, the SJNF and TRFO may continue to play a role in area migration as a major pull factor.

Alternatives would allocate different acreages to the various ROS prescriptions. The availability of land under ROS prescriptions varies between alternatives (for example, Alternative C would propose far more “primitive” acres than would the other alternatives). However, while the presence of recreational opportunities seems to influence migration, it is nearly impossible to determine how allocation of acreages for one setting or another may impact migration. All of the alternatives offer diverse recreation settings, and this may result in a wide appeal for continued migration into the region. However, it would overstate the scope of the descriptive methodology used in this analysis to attempt to determine how, and to what degree, the alternatives may impact pull factors.

Impacts Related to Amenities and Perceived Quality of Life – Scenery

All of the alternatives would involve the assignment of public lands to various BLM VRM classes and USFS scenic integrity levels. The alternatives would all aim to preserve scenery and enhance access to opportunities to enjoy it. In this respect, the potential impacts of any of the alternatives may contribute to maintaining scenery as an important pull factor for migration into the analysis area.

Alternative C would be expected to provide the highest quality scenery, followed by Alternatives B, D, and A, respectively. Differences in migration pull factors due differing acreages designated under scenic integrity levels or VRM classes under the various alternatives are likely to be small.

Impacts Related to Environmental Justice

Minorities, including American Indians and Hispanics, and those with incomes below the poverty level should not see a disproportionate impact as a result of LRMP decisions. Impacts to the general population and communities as a whole are expected to be negligible. There is no reason to anticipate that whatever impacts do occur generally would have a disproportionate impact to those specifically considered within the scope of environmental justice.

Environmental Consequences Summary

Impacts to population would be a potential rise by 2020 of 800 to 1,000 persons in the analysis area. This would be an increase of less than 1% over the current forecast for the analysis area as a whole (see Figure 3.30.2). Because of the where new well drilling would occur under the alternatives, population change would occur throughout the analysis area, with the exception perhaps of San Juan County, and would likely be concentrated in La Plata and Montezuma Counties.

Cumulative Impacts

The recreational opportunities and scenery offered by the public lands within the planning area constitute an important component of the overall package of pull factors enticing new residents into the area. However, migration is also a result of many other decisions, some of which involve push factors in places thousands of miles away (including smog, crime, and traffic). There are also other attractions in the area, such as Mesa Verde National Park, that pull people to the area. The LRMP guidance for recreation and scenery is aimed at continuing to provide these amenities as the region grows and more demands are put upon the SJNF and TRFO. The alternatives would offer various

policies and approaches designed to help land managers prepare for the continued population growth and maintain the attractiveness of the area. No alternative, however, would, by itself, trigger migration. Therefore, selection of any particular alternative may not have an identifiable direct impact on area demographic trends.

3.31 Local Government

3.31.1 Introduction

The fiscal capacity of local government determines how well counties and other units of local government can deliver local services to the community and maintain public infrastructure. SJNF and TRFO managers place a strong emphasis on working in cooperation with all of the local governments within the region to sustain fiscal capacity and minimize the burden of SJNF and TRFO activities.

The following discussion is primarily about the local governments in the counties of Archuleta, Dolores, La Plata, Montezuma, and San Juan, Colorado, referred to collectively as the analysis area. For some revenues, the impacts to San Miguel County are discussed because the alternatives include oil and gas development in this county.

Legal and Administrative Framework

Federal Laws

- **The Mineral Leasing Act for Acquired Lands of 1920, as amended through 1990:** This act established the program administered by the USDI that monitors, collects, and distributes royalties for energy and mineral resources produced and removed from federal and tribal lands.
- **The Materials Act of 1947:** This law authorizes the BLM to sell mineral materials at fair market value and to grant free use permits for mineral materials to government agencies and for a limited amount of material to non-profit organizations.
- **The USDA Appropriations (National Forest Payments) Act of May 23, 1908, as amended:** This act requires payments equal to a 25% share of annual revenue coming from the sale of forest products, user fees, and Special Use Permits (including from grazing) on each national forest.
- **The Secure Rural Schools and Community Self-Determination Act of 2000:** This act offers counties an option for compensation payments that do not fluctuate with national forest revenues. The 1-year extension of the Secure Rural Schools and Community Self-Determination Act of 2000 expired at the end of 2012.
- **The Payment in Lieu of Taxes (PILT) Act of 1976:** This act determined the formula regarding compensation to local governments for the presence of tax-exempt federal lands within their jurisdictions. PILT is a federal revenue-sharing program administered by the BLM. The compensation to local governments is based on the amount of non-taxable acreage within their boundaries, with adjustments for other federal payments.

Colorado Influences

Under Colorado law, there are many ways financial resources originating from activities based on the resources of the SJNF and TRFO flow to local governments. This analysis focuses on the most important of these activities.

- The main sources of federal revenue transferred to Colorado local government are the land payments derived from the Secure Rural Schools/Forest Payments Act and the PILT Act, as well as the minerals payments derived from the Mineral Leasing Act. The receipts go first to the state level, and Colorado law and regulations governs how they are distributed to local governments.
- Federal minerals production also generates state severance taxes, which are partly redistributed to local government.
- The value of federal minerals produced in a Colorado county is subject to the local property tax.
- Purchases by minerals operators on federal lands and their employees indirectly generate Colorado and local sales taxes.

3.31.2 Affected Environment

Local Government Revenues

This discussion focuses on the current contribution to local government of the principal revenue sources that may be directly or indirectly related to activities occurring with the planning area:

- Federal PILT;
- National forest payments;
- Federal mineral lease payments as direct distributions from the Colorado Local Government Mineral Impact Fund (LGMIF);
- Colorado property taxes levied directly by local governments;
- Colorado severance tax payments as direct distributions from the LGMIF; and
- Colorado sales and use taxes levied by state and local government.

Payment in Lieu of Taxes

The PILT Act of 1976 determined the formula regarding compensation to local governments for the presence of tax-exempt federal lands within their jurisdictions. PILT is a federal revenue-sharing program administered by the USDI. The formula takes into account such factors as other forms of revenue sharing, acreage, and population. These payments are made directly to counties, and monies may be used for any purpose. PILT can be, and recently have been, limited by Congress through the appropriations process. Since 1994, Congress has not appropriated sufficient funds in order to fully compensate counties. Federal land payments for 2010 are shown in Table 3.31.1.

Table 3.31.1: Payment in Lieu of Taxes in 2010 to Counties of the Analysis Area

County	Total PILT from NFS and BLM Lands
Archuleta	$871,871
Dolores	$139,213
La Plata	$552,252
Montezuma	$156,648
San Juan	$70,826
Source: USDI (2013)	

National Forest Payments

National forest payments under the National Forest Payments Act equal a 25% share of annual revenues coming from the sale of forest products, user fees, and Special Use Permits (including from grazing) on each national forest. As an alternative, the Secure Rural Schools and Community Self-Determination Act in 2000 provided counties with a fixed-payment alternative to the variable 25% of revenue rule for national forest payments. In the past, Archuleta, Dolores, La Plata, Montezuma, and San Juan Counties all chose fixed payments, and Table 3.31.2 reflects this choice. The Secure Rural Schools and Community Self-Determination Act expired at the end of fiscal year 2012. Unless the law is extended by Congress, all counties would revert to 25% payments under the National Forest Payments Act.

Table 3.31.2: National Forest Payments in 2010 to Counties of the Analysis Area

County	Total of National Forest Payments
Archuleta	$558,202
Dolores	$407,952
La Plata	$249,673
Montezuma	$286,451
San Juan	$146,141
Source: USFS (2010b); All Services Receipts, Final Detail Report PNF (ASR 10-03).	

Federal Mineral Lease Payments

A portion of federal receipts are also returned to states and local governments from minerals royalties, and these are substantial in the analysis area. Table 3.31.3 shows the amount disbursed to schools and local governments within the State of Colorado from federal mineral lease revenues in 2010.

Table 3.31.3: Federal Mineral Lease Disbursement to Counties in 2010

County	Disbursement in 2010
Archuleta	$12,909
Dolores	$477,768
La Plata	$637,069
Montezuma	$2,338,336
San Juan	$92
Source: Colorado Department of Local Affairs (2012).	

Other Federal Payments

Other federal payments to local governments in the analysis area include shares of receipts from the minerals sales from BLM lands. The amount returned was about $15,000 in 2010. Based on reports from Colorado’s Office of the State Auditor, the only other federal payments made to counties in the analysis area were from minerals sales under the Materials Act of 1947.

Colorado Local Property Tax

In Colorado, state law allows local government (counties, cities and towns, schools, and special districts) to tax oil and gas property located within their boundaries. Property tax receipts fund county government services, especially roads and bridges, law enforcement, and the administration of social

services at the local level. A county may tax all property within its boundaries, so the share of total revenue a county generates from oil and gas property is proportional its share of assessed value. Table 3.31.4 shows the assessed value of all taxable property in 2010 for each county of the analysis area. The table also identifies the amount and percentage of total assessed value that was contributed by oil and gas property in 2010.

Table 3.31.4: Total Assessed Value for 2010 and Percentage from Oil and Gas

County	Assessed Value	Oil and Gas Assessed Value	Percentage of Property Tax Base from Oil and Gas
Archuleta	$424,332,879	$20,354,060	5%
Dolores	$78,952,586	$36,096,749	46%
La Plata	$2,354,797,050	$937,311,060	40%
Montezuma	$543,765,410	$241,485,350	44%
San Juan	$57,605,250	–	0%
San Miguel	$965,168,630	$26,180,490	3%
Total	$4,424,621,805	$1,235,247,219	28%
Source: Colorado Department of Local Affairs (2012).			

Where there is more than one school district, the districts divide up the county tax base. In the analysis area, Archuleta, Dolores, and San Juan Counties each contain one school district. La Plata and Montezuma Counties each contain three school districts.

The size of a school district's tax base largely determines the share local property owners contribute to funding their public schools, with general revenue from the state filling in the rest up to the authorized amount per pupil. Since property is taxed where it is found, taxable values including those from oil and gas may be divided up unevenly in cases where there are several districts in a county.

The tax base of a special district is generally a fraction of the larger county tax base because special districts are created to fund improvements and services in specific areas outside cities and towns. Special districts, too, may have uneven shares of a county's total oil and gas property valuation.

Though cities and towns rely mostly on the sales tax (see the section on sales taxes below) they can tax property, and many do, to raise revenue for improvements. However, city limits in the analysis area historically do not contain much oil and gas property, so oil and gas has not been a large revenue source for cities and towns.

Emphasis in the past on development of the San Juan Basin has given La Plata County the majority of oil and gas property value in the analysis area, totaling about $1 billion in 2010 and equaling about 40% of total assessed value in La Plata County (see Table 3.31.4). Montezuma and Dolores Counties have smaller tax bases and smaller amounts of oil and gas assessed value. However, oil and gas was a bigger share of the tax base in 2010 in Montezuma County (44%) and Dolores County (46%). For the analysis area as a whole, oil and gas assessed value was $1.2 billion in 2010 and 28% of total assessed value (Figure 3.31.1).

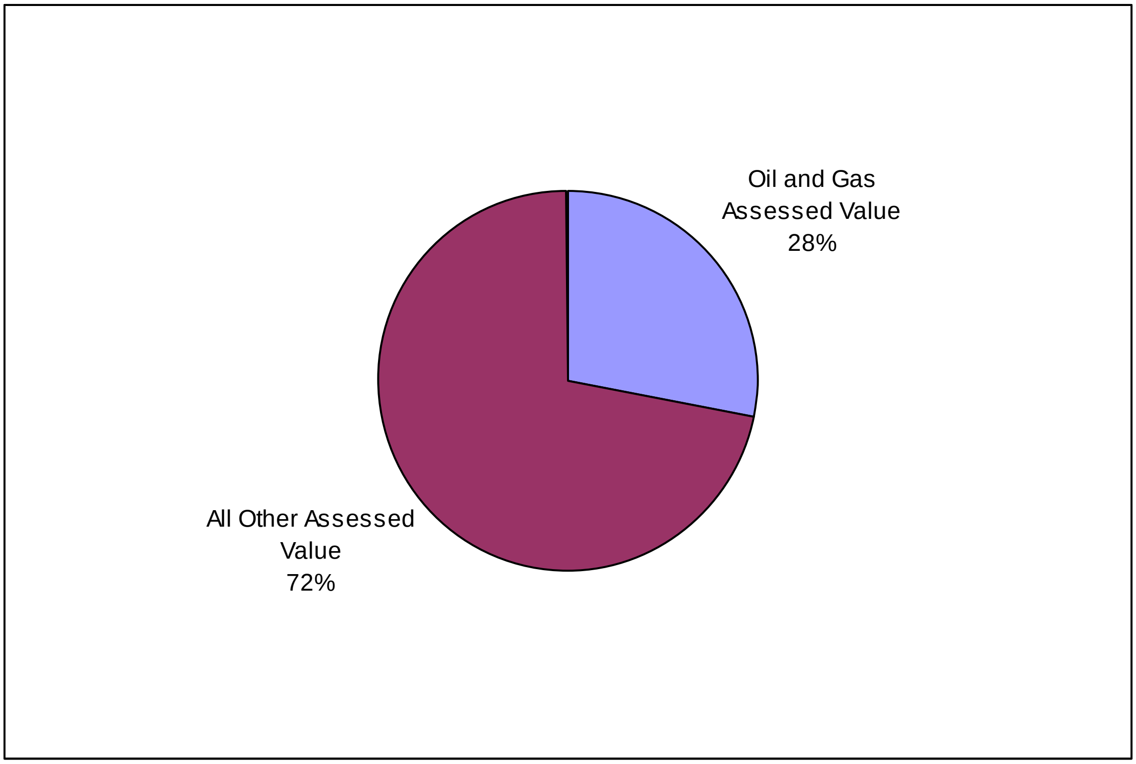


Figure 3.31.1: Oil and Gas as Share of the Total Property Tax Base in 2010 for All Counties of the Analysis Area (Source: Colorado Department of Local Affairs 2010b)

Table 3.31.5 shows how much the different types of local government received from property taxes in 2010 in the analysis area. All types of government in the five counties of the analysis area—Archuleta, Dolores, La Plata, Montezuma, and San Juan—collected $132 million in property taxes in 2010; the total was $171 million if San Miguel County is included in the group.

Table 3.31.5: Property Tax Revenue by County for 2010

County	County Government	Municipalities and Special Districts	School Districts	Total
Archuleta	$7,784,387	$7,727,449	$9,402,636	$24,914,472
Dolores	$2,211,699	$806,529	$1,574,946	$4,593,174
La Plata	$20,015,775	$20,637,752	$33,838,662	$74,492,189
Montezuma	$7,750,832	$7,670,368	$11,115,294	$26,536,494
San Juan	$1,162,416	$466,030	$764,652	$2,393,098
San Miguel	$9,767,507	$18,495,955	$10,103,778	$38,367,240
Source: Colorado Department of Local Affairs (2010b).				

Colorado severance tax is calculated on the gross income from oil and gas and CO_2 production, with the exception that taxpayers are allowed a credit of 87.5% of the local property tax paid on oil or gas production (though not the property tax on oil and gas facilities or equipment).

Distribution of total state severance tax revenue is similar to distribution of federal mineral lease receipts. Fifty percent is retained by the state and 50% goes to the LGMIF. From the LGMIF, 30% is distributed directly to local governments (using formulas slightly different from but similar to the

federal mineral lease formulas). The remainder is for competitive grants to local government. Table 3.31.6 shows the amount of severance tax revenue distributed to the local government in the analysis area in 2010.

Table 3.31.6: Severance Tax Revenue Direct Distributions by County for 2010

County	County Government	Municipalities	Total
Archuleta	$15,473	$3,566	$19,039
Dolores	$55,014	$23,265	$78,279
La Plata	$637,728	$211,961	$849,689
Montezuma	$194,241	$74,904	$269,145
San Miguel	$111,599	–	$11,599
Source: Colorado Department of Local Affairs (2010a).			

Sales Tax Revenues

Sales tax rates vary between 1% and 4% for counties and municipalities associated with the planning area. Due to Colorado's fiscal structure, the sales tax is the most important revenue source for municipalities. Sales tax collections rise and fall with changes in the migration of people to the analysis area and the ups and downs of tourist-related sales. Table 3.31.7 shows the sales tax revenues at the state and local government levels in the analysis area in 2010. The sales tax revenue to state government is the second largest input to the general fund. The principal local benefit of the state general fund is funding of public elementary and secondary schools, which is the largest single line-item appropriation in the state general fund.

Table 3.31.7: Sales Tax Revenues to Colorado and Local Government, 2010

	To State	To County Government	To Cities & Towns	Total to County, Cities, and Towns
County	**FY 2010**	**FY 2010**	**FY 2010**	**FY 2010**
Archuleta	$3,315,087	$2,858,733	$1,713,801	$4,572,534
Dolores	$230,347	$0	$156,879	$156,879
La Plata	$20,136,534	$13,887,265	$15,778,346	$29,665,611
Montezuma	$7,471,917	$0	$8,842,891	$8,842,891
San Juan	$351,871	$446,487	$108,384	$554,871
Total	**$31,505,756**	**$17,192,485**	**$26,600,301**	**$43,792,786**
Source: Colorado Department of Revenue (2010) for sales tax revenue to the State of Colorado. Local government tax revenue was estimated by Lloyd Levy Consulting LLC.				

Local Government Costs

As population increases occur, private development often increases near USFS and BLM boundaries. Typically, homes situated adjacent to planning area boundaries offer more privacy, better views, greater opportunities for recreation and wildlife viewing, and more pleasant immediate surroundings than those situated further away from public lands. These amenities are highly valued by homeowners. However, along with these developments come higher costs of services provided by local governments. Irregular boundaries, less developed roads, and longer distances from community centers make for expensive law enforcement, public school systems, and emergency services.

The costs borne by local governments for serving visitors to the planning area include law enforcement and judicial services and rescue and other emergency services, as well as the costs associated with increased wear on local public infrastructure.

Road Maintenance and Improvement

The state highway system, county road networks, municipal streets, and USFS/BLM roads form the transportation network in southwest Colorado. Public lands are often accessible only by county road and municipal streets. Some costs are associated with providing maintenance for roads taking public use traffic onto public lands.

The use of heavy trucks results in increased impacts to roads when compared to passenger vehicles. Oil and gas development and construction are the two principal sources of heavy truck traffic in non-municipal parts of the analysis area.

Some counties of the analysis area have directly addressed the cost of road use by oil and gas development. La Plata County has individual MOUs with each operator of the wells in the 80-acre infill area of the Fruitland Formation, a gas field. The fee in 2012 was $8,900 per well. The fee is based on an assessment of the cost of the county road maintenance required when produced water (water that comes from a well along with the gas) is taken away by pipeline instead of by truck. The direct costs of water trucking have not been studied recently.

3.31.3 Environmental Consequences

Direct and Indirect Impacts

An estimate of the value of LRMP outputs under each alternative drives assessment of local government fiscal impacts. Impacts to public revenues were estimated by applying factors extrapolated from recent trends or taken directly from the tax rates and apportionments stated in Colorado law and regulations. For each type of revenue, the change in LRMP outputs is translated into a resulting increase or decrease in local government revenue under Alternative A and the difference between other alternatives and Alternative A.

The mechanics of revenue collection, the timing of payments, and the intergovernmental transfers that occur under state law justify the classification of all revenue impacts as "indirect" impacts of the alternatives. Some revenues are more direct than others, as in the case of federal mineral lease and Colorado severance tax direct distributions to local government and the local government property tax.

Sales tax revenues at all levels are an indirect impact because they arise from market transactions that are partly secondary to industry spending and that hinge upon choices made by businesses and households located some distance in time and place from resource development.

Grants and loans made to local government from federal mineral lease and severance tax receipts are discretionary and therefore indirect. The grant program was suspended altogether in August 2010 so that funds could be diverted to the state’s general fund to help address budget shortfalls. It was reinstated in 2012 with a new round of grants to be issued starting in February 2013.

Comparison among Alternatives

The state and local government revenue impacts under the SJNF and TRFO minerals programs would vary by alternative. The differences among the alternatives, as presented below, have been

calculated for the year 2020. Using Alternative A as a reference point, impacts would generally be lower (less revenue) under Alternatives B and C and higher (more revenue) under Alternative D.

The differences among the alternatives are small and may become very small or even nil in specific instances when the impacts are rounded to thousands of dollars, which is an appropriate way to express the magnitude of these projections given the kinds of uncertainty and the inherent imprecision that surrounds them.

The impacts to revenues are shown below in the order they were presented in the Affected Environment section above. The section concludes with a qualitative assessment of the impact to local government costs.

Impacts to Payment in Lieu of Taxes

Current law requires that a county's PILT be reduced dollar for dollar by the FML payments they receive, down to a minimum PILT allowance. Using these assumptions, PILT payments for Archuleta, La Plata, and San Miguel Counties would not change under the alternatives because predicted rises in federal mineral lease payments (see below) would be offset equally by lowering PILT. Dolores and Montezuma Counties have already been receive the minimum allowed PILT, so PILT would not be affected by the alternatives and impacts to federal mineral lease payments to these counties would be a net gain.

Impacts to National Forest Payments

The Secure Rural Schools and Community Self-Determination Act expired at the end of fiscal year 2012 and has not been reauthorized by Congress in the current term. This analysis has assumed the Secure Rural Schools and Community Self-Determination Act would not be reauthorized and that all counties in the planning area would receive payments equaling 25% of receipts under the original Forest Payments Act.

Payments under the Forest Payments Act would be very similar across all of the alternatives and counties would receive much less under the 25% rule than they have previously under the Secure Rural Schools and Community Self-Determination Act. In 2010, total national forest payments under the Secure Rural Schools and Community Self-Determination Act were $1.8 million total to the counties in the planning area as a whole. Under the 25% rule, payments to these counties going forward would likely total about $200,000. This amount would not vary across the alternatives. If Congress extends the Secure Rural Schools and Community Self-Determination Act, payments would likely be closer to those of the past.

National forest payment amounts do not vary much across alternatives because they are based on the SJNF and TRFO timber, recreation, range, special uses, and non-oil and gas minerals programs. These programs are generally smaller than the oil and gas leasing program and they do not vary by alternative.

Impacts to Federal Mineral Lease Payments

Federal mineral lease royalty payments to the State of Colorado are one of the most immediate revenue effects of the LRMP alternatives. The payments directly shadow the value of oil and gas produced from federal minerals.

Approximately 49% of FML royalties are returned to the state. Twenty percent of the state's receipts are directly distributed to local general-purpose governments according to a formula based on the

royalty revenue generated by the county, oil and gas worker residency at the county and municipal level, and population and road miles at the sub-county level. Another 1.7% is directly distributed to local school districts according to a formula based on the royalty revenue generated directly by each county, worker residency by county and place, and the number of oil and gas related students by school district.

Table 3.31.8 presents the impact to the state's federal mineral lease receipts under the range of alternatives in the year 2020, assuming a 12.5% royalty rate on the projected value of production at the 2010 price of $3.96 per thousand cubic feet.

Table 3.31.8: Impacts to Local Receipts from Direct Distribution of Federal Mineral Lease Revenue in 2020 by Alternative (in thousands of dollars)

	2010	2020	Change from Alternative A in 2020			
County	Base Year	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
Archuleta	$871,871	$3,266	($41)	($33)	$6	$(403)
Dolores	$139,213	$120,400	($1,509)	($1,208)	$232	($14,856)
La Plata	$552,252	$160,638	($2,013)	($1,611)	$310	($19,821)
Montezuma	$156,648	$589,656	($7,389)	($5,914)	$1,137	($72,756)
San Miguel	$0,826	$2,167	($779)	($623)	$120	($7,671)

Other state and local federal mineral lease revenues are also considerable but uncertain, so they are not estimated here. These include the 20% of state federal mineral lease receipts from production royalties that go to the Energy and Minerals Impact Assistance Fund for competitive grants to local jurisdictions that were reinstated in May of 2012 after have been suspended in 2010. The announced resumption included plans to grant $20 million to local governments affected by energy minerals development beginning as early as February 2013.

Federal mineral lease receipts from production royalties are also retained at the state level for the Public School Fund, the Water Conservation Board, and the Higher Education Fund. Federal mineral lease bonus payments (one-time payments made when a mineral lease is granted) go to the Higher Education Reserve Fund and the Local Government Permanent Fund. The latter is used to smooth out the direct distributions to local government.

Impacts to Other Federal Payments

In the SJNF and TRFO, this category of federal payments includes just the sale of materials under the Materials Act of 1947. The total received in the past for the entire SJNF and TRFO has been about $15,000. No impact is predicted to this current level of receipts under the alternatives.

Impacts to the Colorado Local Property Tax

The local property tax on oil and gas development is location-specific. The tax is levied and received by the jurisdiction that contains the well or other property. Most taxable value is directly attributable to the mineral estate (the minerals deposit that lies underground); the adjusted sales value of the oil or gas that is produced and sold is used as the actual value of this kind of property. Approximately 87.5% of the actual value is the assessed value subject to the tax rate, or mill levy.

The LRMP alternatives locate new wells by county only, so there is no way to project revenue to particular jurisdictions. Instead, Table 3.31.9 presents an estimate of total "rural" property tax revenue, assuming virtually all development is outside cities and towns. The tax rate that is used to

make the projected revenue is the average calculated for all non-municipal tax jurisdictions using the last year of complete data, which is 2010 for this analysis.[1] As is done when calculating the impacts to federal mineral lease payments, production is valued for the property tax calculation at the 2010 price of $3.96 per thousand cubic feet.

Table 3.31.9: Impacts to Local Property Tax in 2020 by Alternative (in thousands of dollars)

	2010	2020	Change from Alternative A in 2020			
County	Base Year	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
Archuleta	$24,914	$1,620	($20.30)	($16.25)	$3.123	$2,800
Dolores	$4,593	$1,748	($21.91)	($17.54)	$3.371	$1,533
La Plata	$74,492	$3,053	($38.25)	($30.61)	$5.885	$2,676
Montezuma	$26,536	$3,794	$7.315	($38.05)	$7.315	$3,326
San Miguel	$38,367	$1,091	($13.67)	($10.94)	$2.104	$956.5

Impacts to the Colorado Severance Tax

Impacts to revenue from severance tax direct distributions in 2020 to counties in the analysis area would be small in absolute terms under all alternatives and small relative to the base year. Table 3.31.10 presents the sum of local government receipts within each county.

Table 3.31.10: Impacts to Local Receipts from State Severance Tax in 2020 by Alternative (in thousands of dollars)

	2010	2020	Change from Alternative A in 2020			
County	Base Year	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
Archuleta	$19.04	$0.315	($0.004)	($0.003)	$0.001	$0.284
Dolores	$78.28	$2.519	($0.032)	($0.025)	$0.005	$2.272
La Plata	$849.7	$13.04	($0.163)	($0.131)	$0.025	$11.76
Montezuma	$269.1	$5.038	($0.063)	($0.051)	$0.010	$4.545
San Miguel	$111.6	$0.441	($0.006)	($0.004)	$0.001	$0.398

Severance tax direct distributions to local governments come from a pool of 15% of total severance tax payments to the state. Another 35% of the total goes to the Energy and Minerals Impact Assistance Fund, where it is commingled with the earmarked federal mineral lease receipts and used for grants and loans as described above. As a whole, the severance tax is a variable source of revenue and is difficult to project from just the trend in the value of production. This is because payments in a given year are reduced by the allowance of a deduction for the property taxes paid by the operator 2 years ago.

Impacts to the Colorado State and Local Sales Tax

The sales tax is the most important revenue source for municipalities and is a substantial revenue source for some counties in the analysis area. Table 3.31.11 presents impacts to state and local

[1] For each county, the 2010 average rural tax rate (expressed in "mills" or cents per thousand dollars of assessed value) is derived by subtracting the municipal property tax revenue from the total property tax revenue and dividing by total county assessed value. The revenue estimate approximates the sum impacts to the property tax revenue of county government, school districts, and special districts from new wells in rural areas of each county.

sales tax revenue originating in the analysis area in 2020 compared across all alternatives. Projections of the total economic impact of each alternative, as presented in Section 3.29 of this document, drive the sales tax impacts.[2] The impacts in the table reflect only the business activity attributable to the use and development of resources on the SJNF and TRFO. The base year 2010 revenue shown for purposes of comparison is an estimate of the contribution of business activity attributable to use and development of resources on the SJNF and TRFO at the 2010 level and before potential change due to the alternatives.

Table 3.31.11: Impacts to State and Local Sales Tax in 2020 by Alternative (in thousands of dollars)

County of Origin	Paid to	2010	2020	Change from Alternative A in 2020			
		Base Year	Alternative A	Alternative B	Alternative C	Alternative D	No Leasing Alternative
Archuleta	State	$639.5	$840.0	($6.1)	($7.2)	$4.7	$160.2
	Local	$882.0	$1,158.6	($8.4)	($10.0)	$6.5	$220.9
Dolores	State	$56.19	$82.98	($0.7)	($1.2)	$1.3	$21.0
	Local	$38.27	$56.52	($0.5)	($0.8)	$0.9	$14.3
La Plata	State	$2,944.1	$5,059.9	($52.1)	($53.4)	$25.7	$1,676.0
	Local	$4,337.4	$7,454.3	($78.3)	($78.6)	$37.8	$2,469.1
Montezuma	State	$983.8	$1,560.5	($15.0)	($16.6)	$10.1	$457.8
	Local	$1,164.3	$1,846.8	($17.7)	($19.6)	$12.0	$541.8
San Juan	State	$70.31	$88.40	($0.5)	($0.6)	$0.3	$14.5
	Local	$110.87	$139.41	($0.8)	($0.9)	$0.5	$22.8

Impacts to Local Government Costs

Local governments in the analysis area shoulder the cost of providing general government services, such as property assessment, recordation of documents, elections, planning, and finance. Local governments also provide police and detention services, either through the county sheriff or through municipal departments. They operate courts and employ judges, administer and house local and state funded social services programs, and maintain and repair roads.

Impacts to county expenditures from the LRMP alternatives may be expected to some degree, but they have not been quantified for this analysis. Comparing the alternatives in terms of indicators that have been quantified, namely the employment impacts described in Section 3.29 (of this document) and the revenue impacts described above, strongly indicates that impacts to government costs, should they occur, would be very much the same regardless of alternative.

Past experience in the analysis area and in other public lands regions of Colorado has identified which activities associated with SJNF and TRFO resources are most likely to impose costs on local government under the LRMP alternatives. Passenger vehicle and light truck traffic is the predominant impact associated with recreation resources. The use of heavy trucks for other types of development causes higher impacts to public roads than do the passenger vehicles and light trucks of local residents, livestock operators, and tourism and recreation users of public lands.

[2] The net sales tax yield as a percentage of gross sales was calculated for each industry in the economic model for the base year 2010. This percentage was held constant for all years and for all counties in the model, so the projections of sales tax impacts reflect only the projected changes by alternative in economic activity, expressed as gross sales. The source for data for the net sales tax yield is Colorado Department of Revenue (2010).

Oil and gas development is the predominant heavy industrial use of SJNF and TRFO resources anticipated under the alternatives. The labor force commuting associated with this activity may subject specific public roads to traffic volumes and axle weights that exceed design capacities and structure. This can raise maintenance, repair, and policing costs. Well sites and facilities may require more service and different types of equipment than public safety agencies might use otherwise for typical urban and rural needs and the light vehicle traffic associated with commuting.

Detailed quantitative analysis is needed but not provided here to determine whether these types of costs related to oil and gas activities would exceed revenues under the alternatives. State policy intends for impact revenues from minerals development, as projected above, to balance development-driven impact costs.

Impacts to government operating costs from demand for housing and community services also may occur within the region. These costs are driven by population changes associated with the employment impacts projected in Section 3.29, Economics. The pattern set by minerals development in the region in the recent past is for contractors and their workers to commute into the area from Farmington, New Mexico, which is the region's industry hub. If the pattern holds, population growth and associated community services costs related to the SJNF and TRFO minerals programs would be avoided.

The size of the SJNF and TRFO minerals programs, as measured by the number of wells that would be developed under the alternatives, indicates that the future pace of development would be comparable to that of the recent past. This strongly suggests that new demand for community services that can be tied specifically to the alternatives would be limited, and it is likely that local government would be able to serve limited community growth from the alternatives, should it occur, within the current revenue structure.

In the past, additional costs over and above those offset by the state and local revenues shown above have been identified in connection with oil and gas development. Each county of the analysis area has addressed the issue in its own way, consistent with legal requirements and the local political consensus.

Most past oil and gas development on the SJNF and TRFO has focused, in stages over time, on extraction from conventional, unconventional, and coalbed formations, with CO_2 gas being a resource unique to Montezuma County. The local policies of the past on the management of the fiscal impact of oil and gas development have been based on the experience of these resource types. Different amounts or types of impact may occur as development occurs in shale formations. This possibility is noted here but not examined for lack of a specific “track record” for this type of activity.

CHAPTER 4 – PUBLIC INVOLVEMENT AND COORDINATION

4.1 Introduction

This FEIS and LRMP represent the efforts and involvement of a broad range of participants, including public agencies, tribal councils, and private organizations and individuals. The BLM and USFS met and consulted with various federal, state, tribal, and local agencies throughout the process, including coordination with the Town of Rico and Montezuma County, which assumed more formal roles as cooperating agencies. The SJNF and TRFO conducted and attended many meetings throughout the planning process to keep all interested parties informed and to solicit opinions and input germane to management of resources within the planning area. SJNF and TRFO staff and community participants engaged in dozens of professionally facilitated, well-attended planning events, meetings, study groups, and workshops. In an effort that has far exceeded requirements and typical expectations for public involvement processes, the SJNF and TRFO engaged citizens, community organizations, and government agencies using professional support and innovative media and forums that focused community input directly toward development of the LRMP and FEIS. The focus on features, uses, and conditions of the land resulted in remarkably civil and thoughtful conversations and comments that are pertinent to the task at hand: revising the plans that guide decision-making about managing the land under the jurisdiction of the USFS and BLM. The bulk of this public outreach effort was focused toward the beginning of the plan revision process so that the LRMP could be developed around the issues of most concern to the public. This chapter summarizes this effort.

4.2 Summary of the Scoping Process

The USFS and BLM conducted a broad, thorough, and innovative community-based public input process that far exceeds the typical efforts of a federal lands scoping process and easily meets the basic requirements. The scoping process included several components summarized in Table 4.2.1.

Table 4.2.1: Scoping Overview

Scoping Component	Duration	Forum
Study groups	Jan. 2005–Jan. 2006	21 facilitated open public meetings
On-site town meetings	Summer 2005	3 facilitated open public meetings
Recreation interviews	Jan.–May 2004	83 interviews with recreation groups, outfitters, conservationists
Written comments	1999–2006	Written comments submitted to the SJNF and TRFO
Governmental water roundtable	May 2005 - March 2006	10 monthly meetings
Aspen workshop	Dec. 2004	1 focused workshop

4.2.1 Study Group Meetings

The core of the community input process consisted of 21 study group meetings over a period of 8 months with more than 450 registered attendees (many of which attended several meetings) and dozens of “drop-ins” that attended meetings or portions of meetings but chose not to register for the meetings (see Table 4.2.2). Some meetings attracted over 100 participants. Meetings were held according to 35 specific geographic areas or landscapes making up the planning area (see Table 4.2.2).

All study group meetings were well attended by SJNF and TRFO staff representing the full spectrum of land management disciplines and creating a broad knowledge base for meeting discussions. SJNF and TRFO staff introduced each landscape and provided an active role in facilitating and informing all meeting exercises and discussions. The Fort Lewis College Office of Community Services developed the study group concept and provided meeting scheduling and logistics and partnered with RPI Consulting, facilitator Marcia Porter-Norton, and other local planning professionals for facilitation and comment processing of the study group meetings.

Each study group meeting was open to all participants and was heavily advertised. Each week prior to a scheduled meeting, agency staff sent public notices to dozens of media and information clearinghouse organizations, including the Durango Herald, Denver Post, DCAT TV, KDUR, City Span TV, KSUT, HubWest, Cortez Journal, Telluride Daily Planet, KVFC, Southern Ute Indian Tribe, Free Press, Mancos Times, Rico Bugle, Pagosa Sun, Pine River Times, High Country News, Durango Telegraph, and many other key information dissemination contacts. Meetings were also posted on the official planning website hosted by Fort Lewis College Office of Community Services.

Table 4.2.2: Study Group Meetings

District and Meeting Location	Meeting Date	Geographic Focus
Columbine District FLC Ballroom, Durango, CO	1/25/2006	Missionary Ridge, Lakes
	2/22/2005	Hermosa Creek, La Plata Canyon, Wild Oats
	3/30/2005	Durango, Mayhan
	4/21/2005	Beaver Meadows and HD Mountains
	5/24/2005	Weminuche, Silverton, Animas Valley
	6/29/2005	Vision and Niche Statement
	8/04/2005	Vision and Niche Statement and Wrap-up
Dolores District KoKo's, Cortez, CO	1/20/2005	Upper Dolores, Mesas
	2/17/2005	Boggy Draw, Big Glade
	3/17/2005	Haycamp Mesa, Mancos-Cherry Creek
	4/14/2005	Dove Creek, McPhee, and Cortez
	5/18/2005	Slick Rock, Dry Creek, Disappointment
	6/29/2005	Vision and Niche Statement
	8/04/2005	Vision and Niche Statement and Wrap-up
Pagosa District Jr. High, Pagosa, CO	1/27/2005	Williams Reservoir
	2/24/2005	Turkey Springs, Ute
	3/31/2005	Mosca, Piedra
	4/28/2005	Wolf Creek, Pagosa
	5/25/2005	Square Top, South San Juan
	6/30/2005	Vision and Niche Statement
	8/02/2005	Vision and Niche Statement and Wrap-up
On-site Meetings	6/07/2005	Norwood On-site Meeting: Norwood Area
	6/28/2005	Silverton On-site Meeting: Silverton, Weminuche
	8/31/2005	Rico On-Site Meeting: Rico Area

Each participant attending the study group meeting had the opportunity to register four written place-specific comments about each landscape covered in each meeting. The comments were organized

into four categories: Primary Use, Outstanding Features, Concerns, and Opportunities. Participants recorded each of the written comments on individual comment sheets while they placed corresponding icon stickers representing various comment categories (motorized uses, pet impacts, wildlife habitat, mineral and gas development, etc.) onto full-sized maps to specify the location specific to the comment. Well over 3,000 place-specific comments were collected in this manner.

At the beginning of each study group meeting, participants viewed a slide show presenting the aggregate results of the individual, place-specific comments about the landscapes from the previous meeting in 3-D format. Taking this into consideration, study group participants were randomly assigned to tables with five to 10 participants, one or two professional facilitators, and a SJNF or TRFO staff member to discuss the draft management themes for each landscape. Each comment was recorded by the facilitators during the meeting.

The Fort Lewis College Office of Community Services and RPI Consulting entered all of the input received during study group meetings into a master database and presented it in map database format, enabling agency staff and the interested public to view the comments in their geographic context. Processed comments and accompanying maps were posted on the official planning website so that they were accessible to anyone visiting the website. Processed public input was distributed to LRMP interdisciplinary team meetings where it was carefully considered in the initial stages of planning and in drafting the alternative management themes.

4.2.2 On-site Town Meetings

Since the geographic extent of the SJNF and TRFO encompasses many different transportation corridors, some communities such as Norwood, Rico, and Silverton are isolated from the core of the planning area along U.S. 160, where the majority of the meetings took place. In order to encourage geographically diverse participation and to reach these communities, the SJNF and TRFO took the study group meetings on the road. These meetings were conducted similarly to the regular study group meetings in Cortez, Durango, and Pagosa Springs and were heavily advertised and relatively well attended, with 50+ participants in Silverton, for example.

4.2.3 Recreation Interviews

Recognizing the importance of recreation for public lands planning and to lifestyles in the Southwest, the USFS and BLM initiated a recreation group interview process, conducted by the Fort Lewis College Office of Community Services partnering with RPI Consulting. In total, 83 interviews were conducted with leaders of organized recreation groups, commercial outfitters, stewardship groups, outdoor equipment retailers, and other organized groups with an interest in recreation on public lands. RPI Consulting built a geographic database of the interviews to capture place-specific comments and produced a qualitative summary of the interview findings for use in the planning process. These interviews, conducted during the winter of 2004, were an important component of the information and public input foundation upon which the ensuing recreation components of the scoping process were built.

4.2.4 Written Comments

More than two dozen written comments were submitted to the SJNF and TRFO during the initial scoping period beginning in 1999. This may be a relatively low number of written comments for a full plan revision, but is indicative of the extra time and resources devoted to conducting a meaningful scoping process built on the diverse set forums for authentic community participation. Nonetheless, written comments are an important form of community input and generally offer well-written, concise

statements about specific issues. The written comments represent a broad array of interests ranging from potentially adverse impacts of WSR designations on private land values to a call for protection of three specific freshwater springs in the HD Mountains. Many of the written comments are summaries of concerns voiced during informal meetings with agency staff.

4.2.5 Governmental Water Roundtable

Water resource concerns cut across jurisdictional boundaries and so should planning efforts surrounding water. Recognizing the jurisdictional complexity of water resource management, the USFS and BLM invited local governments, tribal representatives, water conservation districts, and state agencies to be part of the Governmental Water Roundtable. In total, 10 Governmental Water Roundtable meetings were held between May 2005 and March 2006. The purpose of this effort was to:

- Develop mutual understanding of key local issues related to water;
- Develop ideas for the LRMP;
- Guide land management agencies to make water resource portions of land management plans more accessible and easily identifiable;
- Identify issues beyond the scope of the LRMP and discuss forums that would be appropriate for working on those issues; and
- Evaluate proposed and existing WSR designations for area rivers.

4.2.6 Aspen Workshop

The SJNF convened a focused “aspen workshop” in order to draw insights from a number of local and regional authorities on various aspects of aspen ecology, function, and management. Topics included aspen ecology and interdependency with wildlife history and implications of aspen management, the role of aspen in the regional economy, and aspen aesthetics and environmental values. Broad sponsorship for this focused resource workshop included the SJNF, Montezuma County Federal Lands Program, Fort Lewis College Office of Community Services, Mountain Studies Institute, Colorado Timber Industry Association, Rocky Mountain Experiment Station, San Juan Citizens Alliance, Colorado Wild, and Colorado State Forest Service.

4.2.7 Other Relevant Planning Efforts

The LRMP and FEIS draw from an enormous depth of information and community input. Several important planning efforts have been underway during the LRMP revision process, and the USFS and BLM have applied knowledge gained from these related efforts to the LRMP revision. These efforts include community wildfire protection planning, the Northern San Juan Basin Coal-Bed Methane Environmental Impact Statement and Record of Decision (2006), development of the CRA regulations, the Biodiversity Model Project, various USFS and BLM travel management plans, and many other planning projects that have occurred since the initiation of the LRMP revision in 2004.

4.3 Cooperating Agencies

To integrate a regional land management perspective into the LRMP, the USFS and BLM invited more than 30 local governments, tribes, and state and federal agencies to become cooperating agencies for the LRMP revision process (Table 4.3.1). Cooperating agency status provides the opportunity for USFS and BLM managers and other government leaders to work together to achieve desired land management outcomes. It also offers the opportunity for interested agencies or

governments to take on additional roles and responsibilities beyond basic participation opportunities such as attending public meetings and reviewing and commenting on draft documents.

Table 4.3.1: Cooperating Agency Invitees

City	County	State of Colorado	Federal	Tribes
Bayfield	Mineral	Governor	USFWS	All affiliated tribes (see Table 4.4.1 below)
Ignacio	Archuleta	Colorado Department of Natural Resources	Bureau of Reclamation	
Pagosa Springs	Hinsdale	CPW	Mesa Verde	
Durango	La Plata	Colorado Department of Transportation	USDA - Animal and Plant Health Inspection Service - Wildlife Services	
Cortez	Montezuma	State Historic Preservation Office		
Dolores	Dolores			
Mancos	San Juan			
Rico	San Miguel			
Silverton	Conejos			
Telluride	Rio Grande			
Dove Creek				

In addition to being specifically invited to be cooperators, these governments and agencies were encouraged to attend study group meetings with public notices sent to key government or agency contacts for each meeting. The Town of Rico and Montezuma County formally agreed to be cooperating agencies during the planning process and developed an MOU with the USFS and BLM outlining each party’s various responsibilities with regard to the planning process.

Additionally, representatives from other interested federal and state agencies and tribes provided the USFS and BLM with ongoing verbal and/or written comments, as well as planning information, including geographic data layers and information. During May and June 2013, USFS and BLM officials met with the Boards of County Commissioners from Archuleta, Dolores, Hinsdale, La Plata, Mineral, Montezuma, San Juan, and San Miguel Counties to provide a general overview of the LRMP. Agency officials met with the Town of Rico in May 2013.

4.4 Consultation with Tribes

In accordance with NEPA, the NHPA, and EO 13007, the USFS and BLM have consulted with the 26 tribes affiliated with lands managed by the SJNF and TRFO since the initiation of the LRMP revision effort. All 26 tribes were informed of the process and were offered a visit from agency officials to gather input and provide further information about the LRMP revision (Table 4.4.1). These tribes were invited to be cooperating agencies on the LRMP revision.

Table 4.4.1: Affiliated Tribes

Jicarilla Apache Nation	Pueblo of San Ildefonso
Kewa Pueblo (formerly Pueblo of Santo Domingo)	Pueblo of Sandia
Navajo Nation	Pueblo of Santa Ana

Ohkay Owingeh (formerly Pueblo of San Juan)	Pueblo of Santa Clara
Pueblo of Acoma	Pueblo of Taos
Pueblo of Cochiti	Pueblo of Tesuque
Pueblo of Isleta	Pueblo of Zia
Pueblo of Jemez	Southern Ute Indian Tribe
Pueblo of Laguna	The Hopi Tribe
Pueblo of Nambe	Uintah and Ouray Ute Indian Tribe
Pueblo of Picuris	Ute Mountain Ute Tribe
Pueblo of Pojoaque	Ysleta del Sur Pueblo
Pueblo of San Felipe	Zuni Tribe

During the course of the planning process there were several face to face meetings with the tribes and pueblos, in addition to letters updating them on the progress of the LRMP and inviting them to consult. Table 4.4.2 summarizes these consultation efforts. Comment letters were received from some of the tribes during the formal comment periods for the Draft EIS and Supplement to the Draft EIS. Details and full text of comments can be found in the project record.

Table 4.4.2: Tribal Consultation

Step in Process	Date	Forum	Tribes/Pueblos Involved	Results
Scoping	Jan. 20, 2005	Letter and invitation to be cooperators	26 affiliated tribes	Jicarilla requested meeting.
	Mar. 10, 2005	Meeting	Jicarilla Apache Nation	No comments.
Draft LRMP/EIS	Oct. 5, 2007	Meeting with Mark Stiles, Center Manager, San Juan Public Lands Center	Navajo Nation, Pueblo of Jemez, Pueblo of Laguna, Pueblo of Nambe, Pueblo of Santa Ana, Pueblo of Santa Clara	No comments.
	Oct. 16, 2007	Meeting with Mark Stiles, Center Manager, San Juan Public Lands Center	Ute Mountain Ute Tribal Council	No comments.
	Oct. 19, 2007	Letter	Southern Ute Tribal Chairman	No response.
	Dec. 14, 2007	Draft LRMP/EIS documents and letter	26 affiliated tribes	No comments.
	Jan. 15, 2008	Follow-up letter	26 affiliated tribes	March 2008: The Navajo Nation stated they did not have any Traditional Cultural Properties within the SJNF and TRFO. The letter also stated that they wished to be kept informed of the planning process. The Hopi Tribe stated they would prefer the No Lease Alternative, and that they consider all Ancestral Puebloan sites within the SJNF and TRFO to be Traditional Cultural Properties.

Step in Process	Date	Forum	Tribes/Pueblos Involved	Results
Draft LRMP/EIS (Continued)	April 23, 2008	Hopi CRATT meeting in Kykotsmovi, Arizona, with Mark Stiles, Center Manager, San Juan Public Lands Center, Thurman Wilson, Assistant Center Manager for Planning, and Julie Coleman, San Juan Public Lands Lead Archaeologist	The Hopi Tribe	Preferred Alternative C and the No Leasing Alternative. Would like the LRMP/EIS to focus on special designations to prevent surface disturbance on more of a landscape scale instead of at the site scale. Leasing stipulations were explained by specific area. They stated that they are most interested in the more southern half of the planning area, including Chimney Rock. They stated that enlarging the area around Chimney Rock with CSU or NSO is a good example of what they want.
	Sept. 9, 2009	Annual USFS and BLM tribal consultation meeting held at the Anasazi Heritage Center, with Mark Stiles, Center Manager, San Juan Public Lands Center	Navajo Nation, Pueblo of Acoma, Pueblo of Cochiti, Pueblo of Isleta, Pueblo of Jemez, Pueblo of Nambe, Pueblo of San Ildefonso, Pueblo of Sandia, Pueblo of Santa Ana, Pueblo of Santa Clara, Pueblo of Zia, Southern Ute Indian Tribe, Ute Mountain Ute Tribe, Ysleta del Sur Pueblo, Zuni Tribe	No comments.
	Sept. 7, 2010	Annual USFS and BLM tribal consultation meeting held at the Anasazi Heritage Center with Mark Stiles, Center Manager, San Juan Public Lands Center	Jicarilla Apache Nation, Ohkay Owingeh, Pueblo of Jemez, Pueblo of Nambe, Pueblo of Santa Ana, Pueblo of Santa Clara, Southern Ute Indian Tribe, Ute Mountain Ute Tribe, Pueblo of Acoma, Zuni Tribe	<u>The Southern Ute Indian Tribe</u> had questions about the impact of fracturing geologic formations on the water. <u>Ohkay Owingeh</u> wanted to know how much the federal government receives from the oil and gas leases.

Step in Process	Date	Forum	Tribes/Pueblos Involved	Results
Supplemental LRMP/EIS	Sept. 8, 2011	Annual USFS and BLM tribal consultation meeting held at the Anasazi Heritage Center, with Mark Stiles, Center Manager, San Juan Public Lands Center	Jicarilla Apache Nation, Navajo Nation, Ohkay Owingeh, Pueblo of Acoma, Pueblo of Jemez, Pueblo of Nambe, Pueblo of San Ildefonso, Pueblo of Santa Ana, Pueblo of Santa Clara, Pueblo of Zia, Southern Ute Indian Tribe, Ute Mountain Ute Tribe, Northern Ute Tribe	Ohkay Owingeh concerned over the impact of drilling to water. Thought it would be good if there was a bit more control so it could be done step by step, maybe the local tribal experts (Southern Ute, Jicarilla, and Ute Mountain Ute) could be involved. The Navajo Nation questioned when and how cultural surveys are required within the leasing/development process on such a large geographic area. Santa Ana Pueblo was concerned that the tribes do not have an opportunity to participate. This impacts their ancestral homes.
	Sept.28, 2011	Supplement to the Draft EIS	26 affiliated tribes	No formal comments.
	Sept. 6, 2012	Annual USFS and BLM Tribal consultation meeting held at the Anasazi Heritage Center, with Mark Stiles, Supervisor, SJNF and Connie Clementson, Tres Rios Field Office Manager	Jicarilla Apache Nation, Ohkay Owingeh, Pueblo of Acoma, Pueblo of San Ildefonso, Pueblo of Santa Ana, Pueblo of Santa Clara, Southern Ute Indian Tribe, The Hopi Tribe, Ute Mountain Ute Tribe	No comments.

4.5 Public meetings on Draft Land and Resource Management Plan and Environmental Impact Statement

In early 2008, accompanying the release of the Draft LRMP and EIS, and during the comment period, the SJNF and TRFO held a series of 10 public meetings: three were held in Durango, two in Cortez, two in Pagosa Springs, one in Rico, one in Silverton, and one in South Fork. Approximately 650 people attended these meetings.

Meetings were also held with many governmental entities including the EPA, CPW, Mesa Verde National Park, the Colorado State Historic Preservation Office, the Town of Rico, and the surrounding county governments of La Plata, Montezuma, Mineral, and San Miguel. Tribal meetings are described in Section 4.4 above.

Additionally, meetings were held with stakeholder groups who had been involved with development of the LRMP, such as the Governmental Water Roundtable, San Juan Citizen's Alliance, Southwest Resource Advisory Council, Town of Ouray, and Air Quality Stakeholders Group.

The purpose of all of these meetings was to answer questions and explain the content of the Draft LRMP and EIS. The meetings also encouraged submission of comments during the official 120-day comment period.

4.6 Public Meetings on the Supplement to the Draft Environmental Impact Statement

When the Supplement to the Draft EIS was released in the fall of 2011, additional meetings were held to explain the content and analysis in the supplement. Four public meetings were held in Durango, Norwood, Dove Creek, and Cortez. These are the communities most likely to be impacted by oil and gas development, which is the subject of the Supplement to the Draft EIS.

Governmental and organizational meetings were also held with Mesa Verde National Park, La Plata County, Southwest Resource Advisory Council, Town of Rico, Southern Ute Indian Tribe, Ute Mountain Ute Tribe, and San Juan Citizen's Alliance. Conference calls were held with other Counties of San Miguel, Montezuma, and Dolores.

4.7 Public Comments on the Draft and Supplemental Land and Resource Management Plan and Environmental Impact Statement

Regulations require that lead agencies evaluate comments received from persons who review a Draft LRMP/EIS and prepare a written response. Volume III, Appendix S is a summary of the substantive public comments received on the Draft LRMP/EIS and the Supplement to the Draft EIS for the SJNF and TRFO, and the agency responses to those comments.

The SJNF and TRFO provided the public a 120-day comment period for the Draft LRMP/EIS. The comment period began on December 14, 2007, and ended on April 11, 2008. A 90-day comment period was also provided on the Supplement to the Draft EIS from August 26 to November 25, 2011. Approximately 54,000 letters were received from members of the public; city, county, state, tribal and federal officials; public interest organizations; and private businesses during these two comment periods. Of these, the vast majority were form letters, with approximately 1,500 letters consisting of original responses or form letters with additional original text.

A standardized content analysis process was conducted to analyze the public letters received, which is designed to extract comments from each letter, evaluate similar comments from different letters, and identify specific topics of concern. Similar topics of concern were grouped together into public concern statements. The final step of content analysis involved determining whether a comment or public concern was *substantive* or *non-substantive* in nature. After completion of the content analysis, substantive public concerns were given to members of the interdisciplinary team for response. Non-substantive comments and public concerns did not receive responses. Further details about this process can be found in Volume III, Appendix S.

Substantive comments originated from over 250 commenters, resulting in identification of approximately 642 public concerns. The most public concerns were identified in the areas of minerals and water quality. Volume III, Appendix S lists the public concerns and the agency responses, along with a table showing which public concerns were stated by which commenters.

4.8 List of Preparers

**No longer assigned to the SJNF or TRFO.

DAVID BAKER**

Recreation/Special Use/Wilderness Program Leader, San Juan National Forest

Education: Bachelor of Science, Recreation Resource Management University of Montana, 1980.

Experience: Over 25 years of experience with the USFS and BLM. Outdoor Recreation Planner for the BLM in Cody and Worland, Wyoming. Since 2002, work experience on the SJNF included fire restoration, planning, recreation and lands special uses, developed and dispersed recreation, and wilderness.

MARK BALL

Wildlife Biologist Program Leader, San Juan National Forest

Education: Bachelor of Science, Wildlife Ecology, 1976; Master of Science, Range Ecosystem Management, University of Florida, 1979.

Experience: Thirty-three years of experience with the USFS on four national forests and national grasslands in two regions as a Range Technician, Range Conservationist, and a Wildlife Biologist. Current Assignment: providing technical assistance and practical knowledge for the wildlife sections of the LRMP and FEIS.

JULIE BELL

Archaeologist, Tres Rios Field Office

Education: Bachelor of Arts, Sociology, University of California, Los Angeles, 1989; Master of Science, Anthropology (emphasis Archaeology), University of California, Riverside, 1998.

Experience: Twenty-one years of experience with the National Park Service and the BLM, including Research Archaeologist with Mesa Verde National Park and Field Office Archaeologist with the TRFO. Experience includes historic preservation, documentation, and compliance with historic preservation laws.

MARY J. BLANCHARD

Civil Engineer, San Juan National Forest

Education: Bachelor of Science, Environmental Engineering, University of Florida, 1991.

Experience: Nineteen years of engineering and environmental experience, including 9 years with the SJNF and the Tongass National Forest, Alaska, as well as 10 years in engineering and environmental consulting. Experience includes transportation and travel management planning, civil design, facility management, construction management, permitting, regulatory compliance, and soil and water remediation.

ROBERT BRANTLINGER

Resource Information Specialist (GIS), San Juan National Forest

***Education*:** Bachelor of Science, Environmental Resource Management, Forestry, Pennsylvania State University, 1985.

Experience: Twenty-eight years of experience with the USFS in Colorado. Past work experience in recreation, hydrology, fisheries, fire, rangeland management and resource information. The last 15 year on the SJNF as Resource Information Specialist with an emphasis on GIS.

SARA BRINTON

NEPA Coordinator and Ecologist, Pagosa Ranger District, San Juan National Forest

Education: Bachelor of Science, Forestry (concentration Forest Biology), Colorado State University, 1991.

Experience**:** Twenty-four years of experience with the USFS in Colorado, working in ecology, botany, forestry, rangeland management, fuels management, and fire.

JENNIFER M. BURNS**

Landscape Architect, San Juan National Forest

Education: Bachelor of Science, Renewable Natural Resources, University of Arizona, 1980; Masters in Landscape Architecture, University of Arizona, 1987.

Experience: Twenty-five years of experience in public land management. Experience includes work as a Landscape Architect in Regions 2, 3, and 6 on the Mt. Hood and Deschutes National Forests, Oregon, and the Prescott and Coconino National Forests, Arizona; and work as a Resource Management Specialist for the National Park Service at Grand Canyon National Park and Chiricahua National Monument, Arizona, and Lassen National Park, California.

JEFF CHRISTENSON

Supervisory Outdoor Recreation Planner, Tres Rios Field Office

Education**:** Bachelor of Science, Forest Recreation Resources, option in Resource Planning, Oregon State University, Corvallis Oregon, 1997.

Experience**:** Eleven years of experience as an Outdoor Recreation Planner for the BLM on the Challis Field Office, Idaho, and TRFO. Previous work experience includes fieldwork in the recreation program for the BLM and USFS from 1995 to 2001.

JULIE COLEMAN

Heritage Team Leader, San Juan National Forest

Education: Bachelor of Art, Geology (emphasis in Archaeology), Western State College, 1990; Master of Arts, History (emphasis in Historic Preservation), Colorado State University, 1992.

Experience: Twenty-two years of experience with the BLM and the USFS. Field Office Archaeologist for the BLM in Worland, Wyoming; Gunnison, Colorado; and Montrose, Colorado. Since 2006, work includes Heritage Team Lead for the San Juan Public Lands Center and SJNF.

DAVID DALLISON**

Timber Program Leader, San Juan National Forest

Education: Bachelor of Science, Forest Management Science, Colorado State University, 1975.

Experience: Twenty-nine years of experience with the USFS in timber management and fire management, and as a Certified Silviculturist and Fire Behavior Analyst.

BRAD DODD

Associate Field Manager/Physical Resources, Tres Rios Field Office

Education: Bachelor of Science, Geology, Mesa College 1978.

Experience: Six years of experience with the BLM and the USFS in Colorado and Utah, working primarily in geology and physical resources. Twenty-eight years experience with the Bureau of Reclamation in Utah, Colorado, and Wyoming in geology, hydrogeology, and safety of dams.

DAVE GERHARDT

Fisheries Program Leader, San Juan National Forest

Education: Bachelor of Science, Environmental Biology, Fort Lewis College, 1983; Master of Science, Aquatic Ecology, University of Wyoming, 1989.

Experience: Twenty-three years of experience with the USFS as a forest-level Fishery Biologist. Education and experience includes emphasis on fish-habitat relationships, population ecology, threatened and endangered species management, and water management.

ANTHONY GARCIA

Wildlife Biologist Program Leader, Pagosa Ranger District, San Juan National Forest

***Education*:** Bachelor of Arts, Wildlife Biology, Adams State College, Colorado, 1995.

***Experience*:** Twenty-two years of experience with the USFS in Colorado, including 17 years as Wildlife Biologist on the SJNF (district and forest-level) and 5 years as a Wildlife Biologist Trainee on the Rio Grande National Forest. Work experience includes management of wildlife and fisheries populations and habitats, ESA Section 7 consultation with the USFWS, NEPA analysis, and prescribed fire and wildland fire management.

IVAN GEROY

Hydrologist, San Juan National Forest

***Education*:** Bachelor of Science, Fisheries and Wildlife Management, Oregon State University, Corvallis Oregon, 2002; Master of Science, Civil Engineering with an emphasis in water resources, Boise State University, Boise Idaho, 2010.

***Experience*:** Six months experience as a Hydrologist with the SJNF. Previous work experience includes 5 years as a Nuclear Propulsion Officer in the U.S. Navy and several field seasons as a graduate student, hydrologic technician, and wildlife technician.

CARA GILDAR

Ecologist, San Juan National Forest

Education: Bachelor of Science, Zoology, Minor in English, University of Florida 1996; Master of Science, Forestry, Northern Arizona University, 2002.

Experience: Thirteen years of experience with the USFS on two national forests and national grasslands in two regions as a Botanist and Ecologist. Six years of experience supporting the BLM in Colorado. Several field seasons as a graduate student, plant ecology technician, and undergraduate researcher.

STEVE HARTVIGSEN

Supervisory Forester, Headwaters Timber Zone (Columbine/Pagosa Ranger Districts), San Juan National Forest

Education**:** Bachelor of Science, Forest Management, Utah State University, 1977.

Experience: Thirty-three years of forest vegetation management with the USFS in Utah, Idaho, and Colorado on six national forests. Certified Silviculturist since 1998. ID team member, Rio Grande National Forest Plan Revision (1994–1997). Also, Utah State University research technician conducting forest vegetation sampling/mapping and cover type development (ECOSYM), Manti-LaSal National Forest.

MICHAEL G. JOHNSON

Renewable Resource Staff Officer, San Juan National Forest

Education: Bachelor of Science, Resource Conservation, University of Montana, 1975; Master of Science, Forest Hydrology, Oregon State University, 1978.

Experience: Thirty-five years of experience with the USFS in Arizona, Idaho, Montana, and Colorado on three national forests and in one regional office. Work experience includes Forest Hydrologist, Regional Hydrologist, District Ranger/Field Office Manager, Staff Officer/Assistant Center Manager, and Renewable Resources Staff Officer.

JUSTIN KINCAID

Hazard Fuels Specialist, Southwest District Bureau of Land Management and San Juan National Forest

Education: B.S., Forest Management, 1996 Colorado State University.

Experience: Twenty-three years of service in wildland fire and fuels management (USFS, National Park Service, and BLM).

TOM KOCHANSKI

Resource Information Specialist, San Juan National Forest GIS Team

Education: Bachelor of Science, Marketing, North Adams State College 1982; Master of Science, Forestry, University of Massachusetts 1987.

Experience: Twenty-one years in GIS/Resource Management. Twelve years working for the USFS on two national forests (SJNF and Santa Fe), 1 year working at Hawaii Volcanoes National Park, and 8 years as the GIS Coordinator for the City of Cortez.

MARK B. LAMBERT

Staff Officer for Planning and Public Service, San Juan National Forest

Education**:** Bachelor of Science, Planning and Resource Management, Brigham Young University, Provo, Utah, 2001; Master of Science, Environmental Studies, University of Montana, Missoula, Montana, 2003.

Experience: Ten years of experience in public land management. Experience includes current position as Planning Program Lead on the SJNF; previous work as Monument Manager of Ironwood Forest National Monument, NEPA and Planning Specialist for the BLM Tucson Field Office, and Planning and Environmental Analyst for BLM Washington Office.

PAMELA LESCHAK

Fluids Geologist, Tres Rios Field Office

Education**:** Master of Science, Geology, Texas A&M University, 1985; Bachelor of Science, Geology, University of South Carolina, 1982.

***Experience*:** Ten years of experience with Amoco Production Company, New Orleans, Louisiana, and Houston, Texas, as a Petroleum Geologist; nine years with the Minerals Management Service, Office of Production and Development, in New Orleans as a Petroleum Geologist; three years with the BLM as a Geologist in the White River Field Office, Meeker, Colorado; and as a Fluids Geologist in the San Juan Public Lands Center in Durango, Colorado. Work experience includes subsurface geological and geophysical field and prospect mapping, cross-section construction, openhole well log analysis and correlation, and integration of engineering and geochemical data into subsurface reservoir models.

RANDY LEWIS**

Hazardous Fuels Specialist, Tres Rios Field Office

Education: Associates Degree, Civil Engineering Technology, Idaho State University, 1974.

Experience: Thirty-three years of experience with the BLM in Idaho and Colorado as a Civil and Petroleum Engineering Technician, Environmental Protection Specialist, and Hazardous Fuels Specialist. Thirty-five years of training and experience with wildfires and the use of wildland fire as a management tool.

SHANNON MANFREDI

Plan Revision Team Leader (Raintree Consulting)

Education: Bachelor of Arts, Humanities, Fort Lewis College 1993; Master of Arts, Political Science, University of Colorado at Denver, 2008.

Experience: Twelve years land management planning experience, including leading interdisciplinary teams in the NEPA process, writing and reviewing environmental analysis documents. Ten years experience in community development, public meeting facilitation, and non-profit management.

STEPHANIE O'DELL**

Abandoned Mine Lands Project Manager/Hazardous Materials Coordinator, Tres Rios Field Office

Education: Bachelor of Arts, Biology (Minors in Chemistry and Geology), University of Northern Colorado, 1980.

Experience: Eight years of experience with the City of Loveland as a Chemist, Industrial Pretreatment Coordinator, and Environmental Protection Specialist/Hazardous Materials (HazMat) Coordinator; 2 years with the Southern Ute Indian Tribe as a Water Quality Specialist/HazMat Coordinator; 7 years with the BLM as a Superfund Site Remedial Project Manager and HazMat Coordinator in Farmington, New Mexico; and 10 years with the BLM and the USFS as the Upper Animas Abandoned Mine Lands Pilot Project Manager/HazMat Coordinator in Durango, Colorado.

KELLY PALMER

Hydrology/Air Program Leader, San Juan National Forest

Education: Bachelor of Science, Geology, Fort Lewis College 1985; Master of Science, Watershed Science, Colorado State University, 1991.

Experience: Twenty-five years of experience with the USFS as a Hydrologist on the Idaho Panhandle National Forest, Idaho; as a District Hydrologist on the Ochoco National Forest, Oregon; and as a Forest Hydrologist/Air Manager on the Dixie National Forest, Utah, and the SJNF. Work experience includes surface and groundwater hydrology, water chemistry, water

rights, fluvial geomorphology, geology, soils, and air management, including air quality and visibility protection.

JIM POWERS**

Minerals/Lands Staff, San Juan National Forest

Education: Bachelor of Science, Forest Products, Business Management, University of Idaho, 1977; Master of Science, Forest Resource Management, University of Idaho, 1988.

Experience: Twenty-eight years of experience in public lands management, including assignments as a Forestry Technician, Recreation Technician, Recreation (and non-recreation) Lands Staff, Operations Research Analyst, Forest Planner, NEPA Coordinator, and Minerals and Lands Program Coordinator.

ANDREW G. RABY**

Physical Scientist/Geologist, San Juan National Forest

Education: Bachelor of Science, Geology, University of New Orleans, 1978; Master of Science, Geology, New Mexico Institute of Mining and Technology, 1982.

Experience: Twenty-seven years of experience with the USFS and the BLM on one national forest and two Regional Offices as a Geologist in the minerals, Comprehensive Environmental Response, Compensation, and Liability Act, lands, and heritage programs; manager of the Chimney Rock Archaeological Area; summer intern with the USGS, CUSMAP project; and uranium geology exploration intern with Plateau Resources LTD.

JESSICA RAMIREZ

Geographer/GIS Specialist, San Juan National Forest

Education: Bachelor of Science, Environmental Studies and Geology, St. Lawrence University, 1999; Master of Arts, Geography, University of Montana, 2004.

Experience: Ten years of experience with the USFS as a GIS Specialist on the SJNF.

JEFF REDDERS**

Ecology and Soils Program Leader, San Juan National Forest

Education: Bachelor of Science, Natural Resources, University of Wisconsin, Madison, 1978.

Experience: Seventeen years of experience with the USFS as an Ecologist/Soil Scientist on the SJNF; 3 years as an Ecologist/Soil Scientist in the Southwestern Regional Office, New Mexico; 4 years as an Ecologist/Soil Scientist on the Carson National Forest, New Mexico; 3 years as an Ecologist/Soil Scientist on the Apache/Sitgreaves National Forest, Arizona; and 1 year as a Soil Scientist on the Hiawatha National Forest, Michigan.

THOMAS RICE

Assistant Field Manager, Tres Rios Field Office

Education: Bachelor of Arts, Humanities-Anthropology and Geology, Fort Lewis College, 1990.

Experience: More than 25 years of experience in Four Corners Region Natural Resource Management that includes private sector, tribal, and federal experience with an emphasis on energy, water, cultural resource, infrastructure, and recreation issues.

BRANDY RICHARDSON

Wildlife Biologist Pagosa Ranger District, San Juan National Forest

***Education*:** Bachelor of Science in Wildlife and Fisheries Ecology Oklahoma State University, 2007.

***Experience*:** Seven years of experience with the USFS on three national forests across Colorado, California, and Utah. Work experience includes management and inventory of wildlife and fisheries populations and habitats, ESA Section 7 consultation with the USFWS, NEPA analysis, and other wildlife program support work.

MARK ROPER

Resource Information Specialist (GIS), Pagosa Ranger District, San Juan National Forest

Education: Bachelor of Science, Natural Resources Recreation and Tourism, Colorado State University, 1994.

Experience: Nineteen years of experience with the USFS across Colorado and Nebraska, including the SJNF, Pike and San Isabel National Forests, Comanche and Cimarron National Grasslands, Rio Grande National Forest, Nebraska and Samuel R. McKelvie National Forests, & Oglala, and Buffalo Gap and Ft. Pierre National Grasslands. Work experience includes Recreation Technician, Cartographic Technician, GIS and GPS Coordinator, database management, map production and data analysis for projects and NEPA planning, wildlife surveys, and wildland and prescribed fire support.

CHRIS SCHULTZ

Wildlife Biologist, Wildlife Program Leader, Columbine Ranger District, San Juan National Forest

Education: Bachelor of Science, Wildlife Biology, University of Vermont, 1982; Master of Science, Ecology (Biology), Utah State University, 1996.

Experience: Twenty years of experience with the USFS and BLM in Colorado on the SJNF and Grand Mesa, Uncompahgre and Gunnison National Forests, and San Juan Field Office as a Wildlife Biologist; 5 years of experience with the Rocky Mountain Regional Office as a Migratory Bird Program Coordinator; and 10 years of experience in private sector migratory bird and raptor research. Work experience includes raptor ecology, migratory bird ecology, carnivore ecology, wildlife management, and Forest Protection Officer.

JARED SCOTT

GIS Coordinator, Tres Rios Field Office

Education: Bachelor of Arts, Geography, University of Colorado, Bolder, 2005; Master of Science, Forestry, Northern Arizona University, Flagstaff, 2008.

Experience: Five years of GIS and natural resource management experience with the with the USFS and BLM. Before working at the TRFO, worked at the Kaibab National Forest for 4 years and was a core member of the Kaibab National Forest Land Managment Plan Revision team. Experience in GIS, cartography, forest ecology, forest pathology, and dendrochronology.

LAURA STRANSKY

Planning Assistant, San Juan National Forest

Education: Bachelor of Arts, Biological Science, Concordia College, Minnesota, 1975.

Experience: Twenty-eight years of experience with the USFS working in timber inventories, public information, and as an Old-Growth Inventory Coordinator and Planning Assistant.

GARY THRASH**

Planning and Environmental Analyst, San Juan National Forest

Education: Bachelor of Science, Biological Science, Colorado State University, 1971.

Experience: Twenty-nine years of experience with the BLM in three offices in two states as a Range Technician, Realty/Recreation Specialist, Environmental Analyst, Ecologist, Resources Staff Supervisor, RMP Team Leader, and as a Planning/Environmental Analyst. Work experience includes 8 years as a Seasonal Technician with the National Park Service and the USFS in Colorado and Washington. Current Assignment: providing technical assistance and practical knowledge for the paleontology, utility corridors, electronic sites, ACECs, and monitoring sections of the LRMP and FEIS.

MARK TUCKER

Rangeland Management Program Leader, San Juan National Forest

Education: Bachelor of Science, Range Management, Humboldt State University, 1979.

Experience: Thirty-four years of experience with the USFS in rangeland and noxious weed management in Colorado and Wyoming. Work experience includes assignments in minerals management, recreation, wildlife, watershed, and special uses.

NATHANIEL WEST

Wildlife Biologist Program Leader, Tres Rios Field Office

Education: Bachelor of Science, Wildlife Biology and Management, 1999.

Experience: Ten years of experience with the USFS and BLM on two national forests and one national grassland and three BLM field offices in three states, including Land Use Compliance Officer, Natural Resource Specialist, and Wildlife Biologist.

BRIAN WHITE

Recreation, Wilderness, and Trails Program Manager, San Juan National Forest

Education: Bachelor of Science, Environmental Science, California State University, Chico, 1994; Master of Science, Natural Resource Management, Central Washington University, 2000.

Experience: Fifteen years in recreation and wilderness program management with BLM and USFS in Washington, Montana, Arizona, California, Idaho. Started on the SJNF in 2011.

THURMAN WILSON**

Planning and Public Services Assistant Center Manager, San Juan National Forest

Education: Bachelor of Science, Forest Resource Management, Ohio State University, 1977.

Experience: Twenty-eight years of experience with the USFS on four national forests (in the Rocky Mountain and Pacific Northwest Regions, the Regional Office for the Rocky Mountain Region, and the Washington Office) as a Forester, Economist, Operations Research Analyst, District Ranger, Staff Officer, and Assistant Center Manger (6 years with shared BLM/USFS duties).

CATHLEEN A. ZILLICH

Physical Scientist, Tres Rios Field Office

Education: Bachelor of Science, Watershed Management, Colorado State University, 1978.

Experience: Thirty-five years of experience with the USFS and BLM on three national forests in two regions, at district and supervisor offices, and for BLM field offices. Work experience includes Forest Hydrologist; water rights, minerals and lands administration; GIS stream inventory; fire restoration; and abandoned mine reclamation. Current assignment: providing technical assistance and practical knowledge for the WSR section of the LRMP/FEIS.

Tres Rios Field Office Leadership

CONNIE CLEMENTSON	***Field Office Manager***
BRAD DODD	***Associate Field Manager/Physical Resources***

San Juan National Forest Leadership

MARK STILES	***Forest Supervisor***
MATT JANOWIAK	***Columbine District Ranger***
KEVIN KHUNG	***Pagosa District Ranger***
DEREK PADILLA	***Dolores District Ranger***

CHAPTER 5 – REFERENCES

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———. FSH 2309.18: This provides direction for designing, building and maintaining USFS trails.

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———. FSH 2609.13, Wildlife and Fisheries Program Management Handbook

———. FSH 7309.11: This provides direction for managing USFS facilities.

———. FSH 7709.55 (Travel Planning Handbook).

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———. FSM 2300: This provides direction for management and planning in relation to recreation, Wilderness, and related resources.

———. FSM 2622

———. FSM 2709, 2710, and 2720: These provide the legal framework for special uses on USFS lands.

———. FSM 4063.03. Research Natural Areas

———. FSM 7300: This provides direction for planning, development, and managing facilities on USFS lands.

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5.2 List of Acronyms

ACEC	Area of Critical Environmental Concern
AML	Appropriate Management Level
AMP	Allotment Management Plan
ANC	acid neutralizing capacity
APD	Application for Permit to Drill
ASQ	allowable sale quantity
ATV	all-terrain vehicle
AUM	animal unit month
BA	Biological Assessment
BCF	billion cubic feet
BCR	Bird Conservation Region
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice
BO	Biological Opinion
CAMx	Comprehensive Air Quality Model with Extensions
CCF	centrum cubic feet
CDNST	Continental Divide National Scenic Trail
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
COA	Condition of Approval
COGCC	Colorado Oil and Gas Conservation Commission
CPW	Colorado Parks and Wildlife
CRA	Colorado Roadless Area
CSU	Controlled Surface Use
CWCB	Colorado Water Conservation Board
DAU	Data Analysis Unit
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FLAG	Federal Land Managers' Air Quality Related Values Work Group
FLPMA	Federal Land Policy and Management Act
FRCC	Fire Regime Condition Class
FSH	Forest Service Handbook

FSM	Forest Service Manual
g/hp-h	grams per horsepower-hour
GIS	geographic information system
GMU	Game Management Unit
GSGP	Gothic Shale Gas Play
HMA	herd management area
hp	horsepower
HUC	Hydrologic Unit Code
IMPROVE	Interagency Monitoring of Protected Visual Environments
IRA	Inventoried Roadless Area
kg/ha-yr	kilograms/hectare-year
km	kilometer
KRCRA	Known Recoverable Coal Resource Area
LCAS	Lynx Conservation Assessment Strategy
LGMIF	Local Government Mineral Impact Fund
LN	lease notice
LRMP	Land and Resource Management Plan
MA	Management Area
MBTA	Migratory Bird Treaty Act
MCF	thousand cubic feet
mg/L	milligrams per liter
MIG, Inc.	Minnesota IMPLAN Group, Inc.
Mm-1	inverse megameters
MMBF	million board feet
MMBO	million barrels of oil
MMCF	million cubic feet
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NAL	not available for lease
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest Service
NHPA	National Historic Preservation Act
NI	no impact
NO_2	nitrogen dioxide
NO_3	nitrate
NOI	Notice of Intent
NO_x	nitrogen oxide
NSJB	Northern San Juan Basin
NSJB-CBM	Northern San Juan Basin Coalbed Methane
NSO	No Surface Occupancy
NVUM	National Visitor Use Monitoring
O_3	ozone
OHV	off-highway vehicle

OMC	organic mass by carbon
ORV	outstandingly remarkable value
Pb	lead
PCA	potential conservation area
PEIS	Programmatic Environmental Impact Statement
PILT	payment in lieu of taxes
PL	Public Law
PLAA	Paradox Leasing Analysis Area
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
PM_{10}	particulate matter smaller than 10 microns in diameter
PNV	present net value
POG	Four Corners Air Quality Task Force Policy Oversight Group
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
RFD	Reasonable Foreseeable Development
RMP	Resource Management Plan
RNA	research natural area
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
ROW	right-of-way
RPA	Forest and Rangeland Renewable Resources Planning Act
SBA	special botanical area
SFP	special forest product
SIO	scenic integrity objective
SJNF	San Juan National Forest
SLT	standard lease terms
SO_2	sulfur dioxide
SO_4	sulfate
SRMA	Special Recreation Management Area
TCF	trillion cubic feet
TL	timing limitation
TRFO	Tres Rios Field Office
TSI	timber stand improvement
TSPQ	timber sale program quantity
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
VRI	Visual Resource Inventory

VRM	Visual Resource Management
WSA	wilderness study area
WSR	Wild and Scenic River
WSRA	Wild and Scenic Rivers Act
WUI	wildland urban interface
µg/m³	microsiemens per cubic meter

5.3 Glossary

This glossary defines terms used by the USFS and the BLM to explain natural resource concepts and management activities specific to this LRMP and FEIS. Some definitions may vary between the land management agencies.

abandoned mine: An abandoned hard rock mine on or affecting public lands administered by the Bureau of Land Management , at which exploration, development, mining, reclamation, maintenance, and inspection of facilities and equipment, and other operations ceased as of January 1, 1981 (the effective date of the Bureau of Land Management’s surface management regulations codified at 43 CFR 3809) with no evidence demonstrating that the miner intends to resume mining.

Abandoned Mine Lands Program: A Bureau of Land Management program that focuses on reclaiming hard rock abandoned mine lands on or affecting public lands administered by the Bureau of Land Management .

acid mine drainage: The outflow of acidic water from usually abandoned, metal ore mines.

actual use: Animal unit months of forage consumed by permitted livestock based on the actual numbers of permitted livestock placed on the respective grazing allotment and actual pasture grazing dates submitted by the livestock grazing permittee and confirmed by periodic agency field checks.

adaptive management: The process of implementing management decisions incrementally, so that changes can be made if the desired results are not being achieved. Adaptive management acknowledges that our understanding of complex ecological systems is limited and we may make mistakes, but the seriousness of these mistakes can be reduced by placing forest management into a consciously experimental framework, carefully observing the ecosystem’s response to our well-intentioned efforts, and modifying our actions appropriately as we learn more about the ecosystem.

affected environment: A physical, biological, social, and economic environment within which human activity is proposed. The natural, physical, and human-related environment that is sensitive to changes from the alternatives.

air pollutant: Any substance in air that could, if in high enough concentration, harm humans, animals, vegetation, or materials. Air pollutants may include almost any natural or artificial matter capable of being airborne, in the form of solid particles, liquid droplets, gases, or a combination of these.

air pollution: The contamination of the atmosphere by any toxic or radioactive gases and particulate matter as a result of human activity.

air quality: Refers to standards for various classes of land as designated by the Clean Air Act (Public Law 88-206: January 1978).

allotment: A designated area of land available for livestock grazing upon which a specified number and kind of livestock are permitted to graze for a certain period. Allotments generally consist of federal and state lands and/or private lands. An allotment may include one or more separate pastures. Livestock numbers and periods of use are specified via grazing permits for each allotment.

Allotments are administered to standard when the responsible manager determines and documents

that the permittee is in compliance and that applicable resource management standards are being met. Where the permittee is not in compliance, necessary corrective actions are initiated and documented.

allotment management plan (AMP): A written plan that implements agency land use plans' goals and objectives through a National Environmental Policy Act grazing decision for one of more grazing allotments. The AMP includes supportive measures, if required, designed to attain specific management goals, including desired conditions, for the grazing allotment. An AMP is prepared in consultation with the grazing permittee(s), lessee(s), and other interested publics. Livestock grazing management objectives are considered in relation to other uses of the range and to renewable resources, such as watersheds, vegetation, and wildlife. The AMP documents seasons of use, the number of livestock to be permitted, needed range improvements, and grazing systems.

alternative: A choice of two or more things. For National Environmental Policy Act purposes, alternatives to the Proposed Action must be examined in the planning process. The discussion of alternatives must define the issues and provide a clear basis for choice by the decision-maker and the public (40 CFR 1502.14).

amenity: Resource use, object, feature, quality, or experience that is pleasing to the mind or senses; typically refers to values for which monetary values are not or cannot be established, such as scenic or wilderness values.

amenity migration: The movement of people for pleasure rather than economic reasons.

analysis area: The geographic area defining the scope of analysis for the project. Sometimes for a particular resource, the analysis area may have to be larger when effects have potential to extend beyond the boundaries of the proposal. May also be referred to as the "planning area."

Analysis of the Management Situation (AMS): Assessment of the current management direction. It includes a consolidation of existing data needed in order to analyze and resolve identified issues, a description of current Bureau of Land Management guidance, and a discussion of existing problems and opportunities for solving them.

animal unit month (AUM): The amount of forage necessary for the sustenance of one cow, an "animal unit" or its equivalent for a period of 1 month (43 CFR 4100).

annual mortality: The average annual volume of sound wood (free from decay) in growing-stock trees that died from natural causes during the period between inventories.

annual operating instructions: Annual instructions, developed with livestock permittees, documenting livestock pasture rotations, seasons of use, forage utilization and/or residual levels, etc. Annual operating instructions implement project-level National Environmental Policy Act decisions documented in the allotment management plan.

appraisal well: a well drilled after a discovery well to gain more information on the producing reservoir such as the elevation of the oil-water contact. Appraisal wells are often cored. An appraisal well is a step-out or delineation well.

aquatic ecosystems: Water-dependent environments that serve as habitat for interrelated and interacting communities and populations of plants and animals. Includes the stream channel, lake or estuary bed, water, biotic communities, and the habitat features that occur therein.

Areas of Critical Environmental Concern (ACECs): Areas within the public lands where special management attention is required (when such areas are developed or used, or where no development is required) in order to protect and prevent irreparable damage to important historic, cultural, and/or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards.

atmospheric deposition: Air pollution produced when acid chemicals are incorporated into rain, snow, fog, or mist and fall to the Earth. Sometimes referred to as "acid rain," it comes from sulfur oxides and nitrogen oxides, products of burning coal and other fuels and from certain industrial

processes. If the acid chemicals in the air are blown into areas where the weather is wet, the acids can fall to Earth in the rain, snow, fog, or mist. In areas where the weather is dry, the acid chemicals may become incorporated into dusts or smokes.

anthropogenic influences: Relating to or resulting from the influence that humans have on the natural world or environment.

Authorized Officer: The U.S. Forest Service or Bureau of Land Management employee who has the authority to select and/or carry out a specific planning action.

avoidance area: Areas with sensitive resource values where rights-of-way and Section 302 permits, leases, and easements would be strongly discouraged. Authorizations made in avoidance areas would have to be compatible with the purpose for which the area was designated and not otherwise be feasible on lands outside the avoidance area.

backcountry byways: Vehicle routes that traverse scenic corridors utilizing secondary or backcountry road systems. National backcountry byways are designated by the type of road and vehicle needed to travel the byway.

base property: Land and improvements owned and used by the permittee for a farm or ranch operation and specifically designated by him to qualify for a term grazing permit.

beneficial outcomes (also referenced as “recreation benefits”): These include improved conditions, maintenance of desired conditions, prevention of worse conditions, and the realization of desired experiences.

beneficial uses: Attributes that are considered useful products of the resource.

benthic macroinvertebrates: Aquatic organisms, without a backbone or spine and visible to the naked eye, living at the bottom of a stream, river, lake, or body of water on, under, and around rocks, sediment, debris, logs, etc.

best available science: Peer-reviewed and other quality-controlled literature, studies, or reports related to planning or project issues.

best management practices (BMPs): Methods, measures, or practices to prevent or reduce water pollution including, but not limited to, structural and non-structural controls, operation and maintenance procedures, other requirements, scheduling, and distribution of activities. Usually, BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, economic, and technical feasibility.

big game: Those species of large mammals normally managed as a sport hunting resource. Generally includes elk, moose, white-tailed deer, mule deer, mountain goat, bighorn sheep, black bear, and mountain lion.

biota: The combined flora and fauna of a region.

Biological Assessment (BA): An evaluation conduced for federal projects requiring an environmental statement in accordance with legal requirements under Section 7 of the Endangered Species Act (16 USC 1536(c)). The purpose of the assessment is to determine whether the Proposed Action is likely to affect any endangered or threatened species.

biological diversity: The full variety of life in an area including the ecosystems, plant and animal communities, species and genes, and the processes through which individual organisms interact with one another and with their environment (USFS 1991). More simply it is defined as the variety of life and its processes.

Biological Evaluation: A documented U.S. Forest Service review of U.S. Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species (FSM 2670.5). Objectives of the Biological Evaluation are to ensure that U.S. Forest Service actions do not contribute to loss of viability of any native or desired

non-native plant or animal species (including threatened, endangered, proposed, or sensitive plant and animal species) or contribute to trends toward federal listing of any species, and to comply with the requirements of the Endangered Species Act that actions of federal agencies not jeopardize or adversely modify critical habitat of federally listed species (Forest Service Manual – Region 2 Supplement 2672.41).

biological soil crusts: A complex mosaic of cyanobacteria, green algae, lichens, mosses, microfungi, and other bacteria (Belnap at al. 2001) that function as living mulch by retaining soil moisture and discouraging annual weed growth. They reduce wind and water erosion, fix atmospheric nitrogen, and contribute to soil organic matter (Eldridge and Greene 1994). Also known as cryptogamic, cryptobiotic, microbiotic, or microphytic soil crusts.

broodstock: A group of mature fish used for breeding purposes to restock or enhance the numbers of fingerlings or fry in streams and lakes.

candidate species: Species for which the U.S. Fish and Wildlife Service has sufficient information on their status and threats to support proposing the species for listing as endangered or threatened under the Endangered Species Act, but for which issuance of a proposed rule is currently precluded by higher-priority listing actions. Separate lists for plants, vertebrate animals, and invertebrate animals are published periodically in the *Federal Register* (from M6840, Special Status Species Manual)

canopy: The branches and leaves that form the crowns of trees, shrubs, or herbs. Canopy usually refers to the uppermost layer of vegetation, but can be used to describe lower layers in a multi-storied forest.

canopy cover: The percentage of the ground surface covered by the vertical downward projection of the outermost perimeter of the plant foliage in a given area.

capability: The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices at a given level of management intensity. Capability depends on current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices, such as protection from insects and disease.

carrying capacity: The average number of livestock and/or wildlife that may be sustained on a management unit compatible with management objectives for the unit. In addition to the site characteristics, it is a function of management goals and management intensity. The maximum population or level of activity that can be supported without degradation of the habitat or the population.

casual use: Activities that involve practices that do not ordinarily cause any appreciable disturbance or damage to the public lands, resources, or improvements and, therefore, do not require a right-of-way grant or temporary use permit (43 CFR 2800). Also means any short-term non-commercial activity that does not cause appreciable damage or disturbance to the public lands, their resources or improvements, and is not prohibited by closure of the lands to such activities (43 CFR 2920). Casual use generally includes the collecting of geochemical, rock, soil, or mineral specimens using hand tools, hand panning, and non-motorized sluicing. It also generally includes use of metal detectors, gold spears, and other battery-operated devices for sensing the presence of minerals, and hand battery-operated dry washers. Casual use does not include use of mechanized earth-moving equipment, truck-mounted drilling equipment, suction dredges, motorized vehicles in areas designated as closed to off-road vehicles, chemicals, or explosives. It also does not include occupancy or operations where the cumulative effects of the activities result in more than negligible disturbance.

cave: Any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge and large enough to permit a person to enter, whether the entrance is excavated or naturally formed. Such term shall include any natural pit, sinkhole, or other opening that is an extension of a cave entrance or that is an integral part of the cave (36 CFR 290).

cavity: The hollow excavated in a tree that is used by birds or mammals for roosting and/or reproduction.

Class I area: The Clean Air Act defines Class I areas as national parks over 6,000 acres and national wilderness areas over 5,000 acres that were in existence before August 1977. (The Weminuche wilderness and Mesa Verde National Park are Class I areas.)

Class II area: In general, all areas not designated as a Class I area are considered a Class II area for air quality protection.

Clean Air Act of 1963, as amended: Federal legislation governing air pollution control.

Clean Water Act, as amended in 1977: Legislation enacted by Congress in 1977 to maintain and restore the chemical, physical, and biological integrity of the waters of the United States. This act was formerly known as the Federal Water Pollution Control Act (33 USC 1344).

climate: The composite or generally prevailing weather conditions of a region throughout the year, averaged over a series of years.

closed: Generally denotes that an area is not available for a particular use or uses; refer to specific definitions found in laws, regulations, or policy guidance for application to individual programs. For example, 43 CFR 8340.0-5 sets forth the specific meaning of “closed” as it relates to off-highway vehicle use, and 43 CFR 8364 defines “closed” as it relates to closure and restriction orders (from H-1601-1, Bureau of Land Management Land Use Planning Handbook).

closed road: A road or segment that is restricted from certain types of use during certain seasons of the year. The prohibited use and the time period of closure must be specified.

Code of Federal Regulations (CFR): The official, legal tabulation or regulations directing federal government activities.

Colorado Roadless Rule: The culmination of a National Environmental Policy Act process involving all U.S. Forest Service inventoried roadless areas within the state of Colorado. The resulting Colorado Roadless Rule prescribes new management criteria for these areas and changed the boundaries of some roadless area units.

commercial forest products: Saw logs, small roundwood, biomass, and other forest products removed in the process of harvesting or cutting trees from U.S. Forest Service lands.

community: A group of one or more populations of plants and animals in a common spatial arrangement; an ecological term used in a broad sense to include groups of various sizes and degrees of integration.

community recreation-tourism market: A community, or communities, dependent on public lands recreation and/or related tourism use, growth, and/or development. Major investments in facilities and visitor assistance are authorized within Special Recreation Management Areas where the strategy is to target demonstrated community recreation-tourism market demand. Here, recreation management actions are geared toward meeting primary recreation-tourism market demand for specific activity, experience, and benefit opportunities. These opportunities are produced through maintenance of prescribed natural resource and/or community setting character and by structuring and implementing management, marketing, monitoring, and administrative actions accordingly.

Conditions of Approval (COAs): Conditions or provisions (requirements) under which an Application for a Permit to Drill or a Sundry Notice is approved.

conifer: Any of a group of needle- and cone-bearing evergreen trees.

connectivity: A condition in which the special arrangement of vegetation types allows organisms to move freely across the landscape.

conservation strategy: A management plan to conserve or sustain particular ecosystem elements such as rare species or habitats.

consumptive water use: Use that permanently removes water from a watershed or a confined aquifer from which it is withdrawn by activities that result in substantial evaporation and evapo-transpiration.

Council on Environmental Quality: An advisory council to the President of the United States established by the National Environmental Policy Act. It reviews federal programs to analyze and interpret environmental trends and information.

cover: Vegetation used by wildlife for protection from predators, breeding, and rearing of young (hiding cover) or to ameliorate conditions of weather (thermal cover).

criteria: Data and information that are used to examine or establish the relative degrees of desirability among alternatives or the degree to which a course of action meets an intended objective.

critical habitat: An area occupied by a threatened or endangered species on which are found those physical and biological features: 1) essential to the conservation of the species, and 2) which may require special management considerations or protection.

crucial winter range: That part of the overall range where 90% of the individuals are located during the average five winters out of 10 from the first heavy snowfall to spring green-up or during a site-specific period of winter as defined for each Colorado Parks and Wildlife data analysis unit.

cryptogamic soil or crust: A thin crust made up of mosses, lichens, algae, and bacteria, known collectively as cryptogams. Cryptogams function as soil builders, forming a spongy layer that helps protect soil from erosion, absorbs moisture, and provides nitrogen and other nutrients for plant growth. Also referred to as cryptobiotic or microbiotic soils or crusts.

cultural resource: Any prehistoric or historic site that is more than 50 years old. The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) having scientific, prehistoric, or social values.

cumulative impacts: Combined impacts of the past, present, and reasonably foreseeable future actions. For example, the impacts of a proposed timber sale and the development of a mine together result in cumulative impacts.

deferment: The delay of grazing to achieve a specific management objective. A strategy aimed at providing time for plant reproduction, establishment of new plants, restoration of plant vigor, a return to environmental conditions appropriate for grazing, or the accumulation of forage for later use.

deferred grazing: The deferment of grazing in a non-systematic rotation with other land units.

deferred rotation: Any grazing system that provides for a systematic rotation of the deferment among pastures.

demographic: Related to the vital statistics of human populations (size, density, growth, distribution, etc.) and the effect of these on social and economic conditions.

denning habitat: The environment lynx use when giving birth and rearing kittens until they are mobile. The most common component is large amounts of coarse woody debris to provide escape and thermal cover for kittens. Denning habitat must be within daily travel distance of winter snowshoe hare habitat—the typical maximum daily distance for females is about 3 to 6 miles. Denning habitat includes mature and old growth forests with plenty of coarse woody debris. It can also include young regenerating forests with piles of coarse woody debris or areas where down trees are jack-strawed.

designated roads and trails: Specific roads and trails identified by the land management agency where motorized vehicle use is authorized. Road and trail designations include the types of vehicles authorized to operate on a specific route and may also include a time of year (season) when motorized use is allowed.

destination recreation-tourism market: National or regional recreation-tourism visitors and other constituents who value public lands as recreation-tourism destinations. Major investments in facilities

and visitor assistance are authorized within Special Recreation Management Areas where the strategy is to target demonstrated destination recreation-tourism market demand. Here, recreation management actions are geared toward meeting primary recreation-tourism market demand for specific activity, experience, and benefit opportunities. These opportunities are produced through maintenance of prescribed natural resource and/or community setting character and by structuring and implementing management, marketing, monitoring, and administrative actions accordingly.

developed recreation: Outdoor recreation requiring significant capital investment in facilities to handle a concentration of visitors on a relatively small area. Examples are ski areas, resorts, and campgrounds.

development well: a well drilled into a producing reservoir that already is reasonably well delineated. The development well will have several producing wells on adjacent drilling and spacing units. Development wells are drilled to efficiently drain the reservoir and have very low risk.

direct impacts (direct effects): Impacts that are caused by the action and occur at the same time and place.

dispersed recreation: Outdoor recreation in which visitors are diffused over relatively large areas. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the people.

disposal: Transfer of public land out of federal ownership to another party through sale, exchange, the Recreation and Public Purposes Act, Desert Land Entry, or other land law statutes.

disturbance: A discrete event, either natural or human-induced, that causes a change in the existing condition of an ecosystem.

diversity: An expression of community structure. The relative distribution and abundance of different plant and animal communities and species within an area. It is “high” if there are many equally abundant species. It is “low” if there are only a few equally abundant species.

dynamic equilibrium: Stream systems normally function within natural ranges of flow, sediment movement, temperature, and other variables, in what is termed “dynamic equilibrium.”

easement: A right afforded a person or agency to make limited use of another’s real property for access or other purposes.

ecological integrity: The capability of an ecosystem to maintain its composition, structure, and function over time, thus maintaining the productivity of the land and a diversity of plants and animals.

ecosystem: Areas with living organisms interacting with each other and with their physical environment. They are dynamic entities shaped by natural processes and disturbances including succession, fire, floods, and wind. Ecosystems occur at various scales, with smaller ones found within larger ones.

ecosystem diversity: The variety of ecosystem types including their composition, structure, and processes.

ecotone: An ecological community of mixed vegetation formed by the overlapping of adjoining communities.

edge: The place where plant communities meet or where successional stages or vegetative conditions within plant communities come together (Thomas 1979).

effects: “Effect” and “impact” are synonymous as used in this document. Environmental consequences (the scientific and analytical basis for comparison of alternatives). Effects may be either direct, which are caused by the action and occur at the same time and place, or indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable, or cumulative.

elk security areas: Habitat that allows elk to remain in a defined area despite an increase in stress or

disturbance associated with the hunting season or other human activities (Lyon and Christensen 1992).

eligibility: Qualification of a river for inclusion into the National Wild and Scenic Rivers System through the determination (professional judgment) that it is free-flowing and, with its adjacent land area, possesses at least one river-related value considered to be outstandingly remarkable (from M-8351, Bureau of Land Management Wild and Scenic Rivers Policy and Program).

emission: A release into the outdoor atmosphere of air contaminants.

endangered species: Any species of animal or plant in danger of extinction throughout all or a significant portion of its range and so designated by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.

Endangered Species Act of 1973 (ESA): A law that sets a policy for conserving animal and plant species that are in danger of extinction.

environment: The physical conditions that exist within the area that will be affected by a proposed project, including land, water, minerals, flora, fauna, and objects of historical or aesthetic significance. The area involved is the area in which significant effects would occur either directly or indirectly as a result of the project. The “environment” includes both natural and human-made conditions.

environmental analysis: An analysis of alternative actions and their predictable environmental effects, including physical, biological, economic, and social consequences and their interactions; short- and long-term effects; and direct, indirect, and cumulative effects.

environmental impact statement (EIS): A detailed written statement as required by Section 12(2)(C) of the National Environmental Policy Act (40 CFR 1508.11). An analytical document prepared under the National Environmental Policy Act that portrays potential impacts to the human environment of a Proposed Action and its possible alternatives. An EIS is developed for use by decision makers to weigh the environmental consequences of a potential decision.

ephemeral streams: Streams that flow only as a direct response to rainfall or snowmelt events. They have no base flow.

erodible soils: Soils that are highly susceptible to detachment and movement when disturbed

erosion: Detachment or movement of soil or rock fragments by water, wind, ice, or gravity. Accelerated erosion is much more rapid than normal, natural, or geologic erosion, primarily as a result of the influence of activities of people, animals, or natural catastrophes.

even-aged management: Actions resulting in the creation of stands in which trees of essentially the same age grow together. The difference in age between trees forming the main canopy level of a stand usually does not exceed 20% of the age of the stand at harvest rotation age.

even-aged regeneration harvest: A timber cutting procedure that creates a new age class of trees by using methods including clearcutting, seed tree, shelterwood, and coppice.

exclusion areas: Areas with sensitive resource values where rights-of-way and Section 302 permits, leases, and easements would not be authorized.

explicit recreation management objective: Specifically targeted recreation activity, experience, and/or benefit opportunities (i.e., recreation opportunity outputs) and their attainment (i.e., recreation outcomes).

exploratory well: a well drilled in order to locate an undiscovered petroleum reservoir, either by discovering a new field or a new shallower or deeper reservoir in a previously discovered field. An exploratory well can also be drilled to significantly extend the limits of a discovered reservoir.

Extensive Recreation Management Area: A public lands unit identified in land use plans containing all acreage not identified as a Special Recreation Management Area. Recreation management actions within an Extensive Recreation Management Area are limited to only those of a custodial

nature.

feasible: Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

Federal Land Policy and Management Act of 1976 (FLPMA): Public Law 94-579, October 21, 1976, often referred to as the Bureau of Land Management's "Organic Act," which provides the majority of the Bureau of Land Management's legislated authority, direction policy, and basic management guidance (from Bureau of Land Management National Management Strategy for OHV Use on Public Lands).

Federal Register: A daily publication that reports Presidential and federal agency documents.

federally listed species: Species that are listed by the U.S. Department of the Interior, U.S. Fish and Wildlife Service, or the National Oceanic and Atmospheric Administration, National Marine Fisheries Service as threatened or endangered.

fellfield: An alpine plant community dominated by cushion plants (forbs) that occurs on wind-swept sites with shallow, rocky, well-drained soils.

fens: Groundwater-fed wetlands that support high biodiversity and unique plant communities. Soil in a fen is saturated with water. Saturation creates low-oxygen conditions that slow down decomposition and promotes the accumulation of organic peat over time.

final regeneration harvest: Timber harvest designed to regenerate a forest stand or release a regenerated stand. This includes clearcut, removal cut of a shelterwood or seed tree system, and selection cut.

Fire Regime Condition Class (FRCC): Fire Regime Condition Classes are a measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, introduced insects or disease, or other management activities.

Fire Regime Condition Class (FRCC) 1: Lands whose fire regimes are within the historical range of variation and whose vegetation attributes (species composition, structure, and function) are intact.

fire suppression: All work activities connected with fire-extinguishing operations, beginning with discovery of a fire and continuing until the fire is completely out.

fish habitat: The place where a population of fish species lives and its surroundings; includes the provision of life requirements such as food and cover.

fishery: The total population of fish in a stream or body of water and the physical, chemical, and biological factors affecting that population.

floodplain: The lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, that area subject to a 1% or greater chance of flooding in any given year.

flora: The plant life characteristic of a region, period, or special environment.

fluid minerals: Oil, gas, coal bed natural gas, and geothermal resources.

forage: Plant material that is available for animal consumption.

forage reserve: A designation for allotments on which there is no current term permit obligation for some or all of the estimated livestock grazing capacity and where there has been a determination made to use the available forage on the allotment to enhance management flexibility for authorized livestock use.

forb: An herbaceous plant without a woody stem other than those in the grass (Poaceae), sedge (Cyperaceae), or rush (Juncaceae) families.

forest land: Land that has at least 25% canopy cover of trees.

forest cover type: A descriptive classification of forest land based on the present vegetative species composition and/or locality (i.e., lodgepole pine, mixed conifer). Most stands are given a classification (stratum label), based on aerial photo interpretation, that includes the forest cover type, size class, density class, and stand development phase.

forest regulation: The control of stocking, harvests, growth, and yields on lands designated as suited for timber production to meet management objectives including sustained yield of timber products.

forest road or trail: A road or trail wholly or partly within or adjacent to and serving the National Forest System and that is necessary for the protection, administration and utilization of the National Forest System and the use and development of its resources.

forest transportation atlas: A display of the system of roads, trails, and airfields of an administrative unit.

forest transportation system: The system of roads, trails, and airfields on National Forest System lands.

form: The mass or shape of an object, which appears unified, often defined by edge, outline, and/or surrounding space.

fragmentation: Process by which habitats are increasingly subdivided into smaller units, resulting in their increased insularity, as well as losses of total habitat area.

functional at-risk: 1) Condition in which vegetation and soil are susceptible to losing their ability to sustain naturally functioning biotic communities. Human activities, past or present, may increase the risks; 2) Uplands or riparian-wetland areas that are properly functioning, but a soil, water, or vegetation attribute makes them susceptible to degradation and lessens their ability to sustain natural biotic communities. Uplands are particularly at risk if their soils are susceptible to degradation. Human activities, past or present, may increase the risks.

grade: A slope states as so many feet per mile or as feet/feet (%).

granite soils: Soils derived from granite bedrock or granite parent materials.

grassland: Areas dominated by grasses and forbs. These areas include foothill and mountain grasslands and grasslands vegetation types.

grazing preference: The total number of animal unit months on public land apportioned and attached to base property owned or controlled by a permittee or lessee.

ground cover: The percentage of biotic and abiotic material (other than bare soil) covering the ground surface, including litter, mosses, lichens, vegetation basal area, and rock fragments. Ground cover plus bare soil equals 100%.

growing stock: A timber inventory classification of live commercial trees meeting specified standards of quality or vigor. Cull trees are excluded. Only includes trees 5.0 inches diameter at breast height and larger.

habitat: An environment that meets a specific set of physical, biological, temporal or spatial characteristics that satisfy the requirements of a plant or animal species or group of species for part or all of their life cycle. The sum total of environmental conditions of a specific place occupied by a wildlife species or a population of such species.

habitat connectivity: Habitat arrangements that allow organisms to move freely across the landscape.

habitat structural stages: Any of several developmental stages of tree stands described in terms of tree size and the extent of canopy closure they create (Wills 1987).

habitat type: An aggregation of all land areas potentially capable of producing similar plant

communities at climax.

hardwoods: A conventional term for the wood of broadleaf trees. In the decision area these trees are generally confined to areas near water.

Heavy metals: Elements having an atomic weight between 63.546 and 200.590, and a specific gravity greater than 4.0, such as copper, iron, manganese, lead arsenic, mercury, zinc, etc.

herb: A flowering plant whose above ground stem is not woody; graminoids and forbs.

Herd Management Area (HMA): Public land under the jurisdiction of the Bureau of Land Management that has been designated for special management emphasizing the maintenance of an established wild horse or burro herd.

hazardous substances: Comprehensive Environmental Response, Compensation, and Liability Act term identifying those substances designated pursuant to Section 1321(b)(2)(A) of Title 33, or 42 USC 9602, or listed in 40 CFR 302 or 355.

hazardous substance release: Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant).

hazardous waste: Refers to a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial threat to human health and the environment.

hiding cover: Vegetation, primarily trees, capable of hiding 90% of a standing adult animal from the view of a human at a distance of 200 feet or less.

historic range of variation (HRV): The range of ecological conditions, including vegetation structure and natural disturbance regimes that occurred during the reference period; the period of indigenous settlement from about 1500 to the late 1800s.

hydrophytic plant: A plant that grows in water or in very moist ground, usually found in riparian areas and wetlands.

impacts: “Effect” and “impact” are synonymous as used in this report. See definition for **effects**.

impaired water body: Streams and lakes that are not meeting their designated uses due to excess pollutants.

indirect effects: Secondary effects that occur in locations other than the initial action or significantly later in time.

integrated pest management (Forest Service Manual 2900): A pest (in this context an invasive species) control strategy based on the determination of an economic, human health, or environmental threshold that indicates when a pest population is approaching the level at which control measures are necessary to prevent a decline in the desired conditions (economic or environmental factors). In principle, integrated pest management is an ecologically based holistic strategy that relies on natural mortality factors, such as natural enemies, weather, and environmental management, and seeks control tactics that disrupt these factors as little as possible. Integrated pest management techniques are defined within four broad categories: 1) biological, 2) cultural, 3) mechanical/physical, and 4) chemical techniques.

integrated prescription: A multiple-use management practice used to select and schedule applications on a specific area to attain desired conditions and objectives. This prescription identifies and quantifies outputs, effects, benefits, and costs of all resources to the extent practical.

Interdisciplinary Team: A group of resource professionals with different expertise that collaborate to develop and evaluate resource management decisions.

intermittent stream: A stream that flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow. During the dry season and throughout minor drought periods, these streams will not exhibit flow. Geomorphological characteristics are not well defined and are often inconspicuous. In the absence of external limiting factors (pollution, thermal modifications, etc.), biology is scarce and adapted to the wet and dry conditions of the fluctuating water level.

invasive species: A non-native to the ecosystem under consideration, and its introduction causes, or is likely to cause, economic or environmental harm or harm to human health (Executive Order 13112).

irretrievable impact: Commitment of a resource would be considered “irretrievable” when the project would directly eliminate the resource, its productivity, and/or its utility for the life of the project.

irreversible impact: The commitment of a resource would be “irreversible” if the project started a “process” (chemical, biological, and/or physical) that could not be stopped. As a result, the resource or its productivity, and/or its utility would be consumed, committed, or lost forever.

issue indicators: A “yardstick” for measuring or comparing any changes associated with each issue or concern by alternative.

jurisdictional wetland: A wetland area delineated and identified by specific technical criteria, field indicators, or other information for purposes of public agency jurisdiction. The public agencies that administer jurisdictional wetlands are the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, and the Natural Resources Conservation Service.

K factor: A soil erodibility factor used in the universal soil loss equation that is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Estimation of the factor takes several soil parameters into account, including soil texture, percent of sand greater than 0.10 mm, soil organic matter content, soil structure, soil permeability, clay mineralogy, and coarse fragments. K factor values range from 0.02 to 0.64, the greater values indicating the highest susceptibilities to erosion.

key habitat: Specific areas within the geographic area occupied by a species in which are found those physical and biological features 1) essential to the conservation of the species and 2) that may require special management considerations or protection.

key viewpoint: The point(s) commonly in use or potentially in use where the view of a management activity is the most disclosing; the location that provides the means of studying the visual impact of alternatives to the landscape.

land classification: When, under criteria of 43 CFR 2400, a tract of land has potential for either retention for multiple use management or for some form of disposal, or for more than one form of disposal, the relative scarcity of the values involved and the availability of alternative means and sites for realization of those values will be considered. Long-term public benefits will be weighed against more immediate or local benefits. The tract will then be classified in a manner, which will best promote the public interest.

land tenure adjustments: Ownership or jurisdictional changes are referred as “land tenure adjustments.” To improve the manageability of the public lands and improve their usefulness to the public, the Bureau of Land Management has numerous authorities for “repositioning” lands into a more consolidated pattern, disposing of lands, and entering into cooperative management agreements. These land pattern improvements are completed primarily through the use of land exchanges, but also through land sales, jurisdictional transfers to other agencies, and through the use of cooperative management agreements and leases.

land use allocation: The identification in a land use plan of the activities and foreseeable development that are allowed, restricted, or excluded for all or part of the planning area, based on desired future conditions.

land use plan: A set of decisions that establish management direction for land within an administrative area, as prescribed under the planning provisions of the Federal Land Policy and Management Act of 1976; an assimilation of land use plan–level decisions developed through the planning process outlined in 43 CFR 1600, regardless of the scale at which the decisions were developed.

lands generally suited for timber harvest: Lands where timber production is compatible with the attainment of desired conditions and objectives established by the Land and Resource Management Plan, and other lands where salvage sales or other timber harvest is necessary for multi-purpose objectives other than timber production.

landscape: The aspect of the land that is characteristic of a particular region or area. Landscape character is the combination of physical, biological, and cultural attributes that gives an area its visual and cultural identity. Each attribute contributes to the uniqueness of the landscape and gives a particular place meaning and value and helps to define a “sense of place.” Landscape character provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity and scenic sustainability. Landscape visibility addresses the relative importance and sensitivity of what is seen and perceived in the landscape. It is a function of many important and interconnected considerations such as number and context of viewers, duration of views, degree of discernible detail (which depends in part on the position of the viewer, i.e. the landscape may be superior, level with, or inferior) and seasonal variation. Landscape visibility inventory and analysis consists of three elements, including travel ways and use areas, concern levels and distance zones.

lease: Section 302 of the Federal Land Policy and Management Act of 1976 provides the Bureau of Land Management’s authority to issue leases for the use, occupancy, and development of the public lands. Leases are issued for purposes such as a commercial filming, advertising displays, commercial or non-commercial croplands, apiaries, livestock holding or feeding areas not related to grazing permits and leases, harvesting of native or introduced species, temporary or permanent facilities for commercial purposes (does not include mining claims), residential occupancy, ski resorts, construction equipment storage sites, assembly yards, oil rig stacking sites, mining claim occupancy if the residential structures are not incidental to the mining operation, and water pipelines and well pumps related to irrigation and non-irrigation facilities. The regulations establishing procedures for the processing of these leases and permits are found in 43 CFR 2920.

lek: A specific location where male grouse congregate and strut to attract and breed with female grouse. Most male grouse return to the same lek every year.

lifeways: The manner and means by which a group of people lives; their way of life. Components include language(s), subsistence strategies, religion, economic structure, physical mannerisms, and shared attitudes.

limited (Bureau of Land Management): Designated areas and trails where the use of off-road vehicles is subject to restrictions, such as limiting the number or types or vehicles allowed, dates and times of use (seasonal restrictions), limiting use to existing roads and trails, or limiting use to designated roads and trails. Under the designated roads and trails designation, use would be allowed only on roads and trails that are signed for use. Combinations of restrictions are possible, such as limiting use to certain types of vehicles during certain times of the year.

linkage area: An area that provides connectivity between blocks of habitat. Linkage areas occur both within and between geographic areas, where basins, valleys, or agricultural lands separate blocks of habitat, or where habitat naturally narrows between blocks.

litter: The dead vegetation on the ground surface usually consisting of leaves, needles, twigs, and bark.

live cull: Live trees that are 5.0 inches diameter at breast height and larger, which are 66% rotten or unable to produce a saw log.

livestock: Species of domestic animals including cattle, sheep, horses, burros, and goats.

locatable minerals: Minerals subject to exploration, development, and disposal by staking mining claims as authorized by the Mining Law of 1872, as amended. This includes deposits of gold, silver, and other uncommon minerals not subject to lease or sale.

long-term sustained-yield timber capacity: The highest wood yield that may be sustained under specified management intensities consistent with multiple-use objectives after stands have reached desired conditions.

lower montane: A terrestrial community that generally is found in drier and warmer environments than the montane terrestrial community. The lower montane community supports a unique clustering of wildlife species.

lynx analysis units: An area of at least the size used by an individual lynx, from about 25 to 50 square miles. A lynx analysis unit is a unit for which the effects of a project would be analyzed; its boundaries should remain constant.

lynx habitat: Primarily coniferous forests that provide a prey base of snowshoe hare.

lands with wilderness characteristics: Bureau of Land Management land areas found to have wilderness characteristics after an objective inventory and evaluation.

macroinvertebrates: Small animals that do not develop a backbone or spine, are found in streams, rivers, wetlands, and lakes, and are large enough to be seen with the eye without the use of a microscope.

maintenance level: Maintenance levels define the level of service provided by, and maintenance required for, a specific road. There are five maintenance levels that are described as follows:

- **Level 1** - Assigned to intermittent service roads during the time they are closed to vehicular traffic. Closures must be for 1 or more years. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities.
- **Level 2** - Assigned to roads open for use by high clearance vehicles. Roads in this maintenance level are low speed, single lane and native surface.
- **Level 3** - Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material.
- **Level 4** - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated.
- **Level 5** - Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated.

management area (MA): An area of land used in planning that consists of similar analysis area, has one prescription assigned, and may not be contiguous.

management direction: A statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

management indicator species (MIS): A species of wildlife, fish, or plant whose health and vigor are believed to accurately reflect the health and vigor of other species having similar habitat and protection needs to those of the selected indicator species.

mastication: The altering of live or dead vegetation into small chunks by grinding, shredding, or chopping using a front-end or boom-mounted rotary blade or drum-type head. It is often used on shrubby vegetation, like Gambel oak, but can also be used in and around woodland vegetation (like

pinyon-juniper) or other relatively small trees (i.e., up to 10 inches in diameter). Mastication is generally used to break up fuel connectivity between ground fuels and canopy fuels.

mean annual increment and culmination of mean annual increment: The total increment of increase of volume of a stand (standing crop plus thinning) up to a given age divided by that age. Culmination of mean annual increment is the age in the growth cycle of an even-aged stand at which the average annual rate of increase of volume is at a maximum. In land management plans, mean annual increment is expressed in cubic measure and is based on the expected growth of stands, according to intensities and utilization guidelines in the plan document or set of documents.

mechanical fuels treatment: Any method to masticate or thin vegetation by hand or by machine (including thinning with chainsaws or any commercial machine, shredder, chipper, or similar equipment.)

mechanical transport: This includes any contrivance that moves people or material in or over land, water, or air that has moving parts, that provides a mechanical advantage to the user, and that is powered by a living or non-living power source. This includes, but is not limited to, bicycles, game carriers, carts, and wagons. It does not include wheelchairs when used as necessary medical appliances. It also does not include skis, snowshoes, rafts, canoes, sleds, travois, or similar primitive devices without moving parts.

mechanical treatment: Any of a variety of methods for cutting woody vegetation (usually trees but also including shrubs, junipers, or oakbrush) that utilizes machinery, ranging from chainsaws, to mastication equipment (e.g., hydroaxe), to feller-bunchers. The treatment could involve just cutting and spreading of woody vegetation or removing some or most of cut material from the site.

metapopulation: A set of partially isolated populations belonging to the same species. The populations are able to exchange individuals and re-colonize sites in which the species has recently become extinct.

mineral: Any naturally formed inorganic material/solid or fluid inorganic substance that can be extracted from the earth, or any of various naturally occurring homogeneous substances (as stone, coal, salt, sulfur, sand, petroleum, water, or natural gas) obtained for human use, usually from the ground. Under federal laws, considered as locatable (subject to the general mining laws), leasable (subject to the Mineral Leasing Act of 1920), and salable (subject to the Materials Act of 1947).

mineral entry: The filing of a claim on public land to obtain the right to any locatable minerals it may contain.

mineral estate: The ownership of minerals, including rights necessary for access, exploration, development, mining, ore dressing, and transportation operations.

mineral materials: Materials such as sand and gravel and common varieties of stone, pumice, pumicite, and clay that are not obtainable under the mining or leasing laws, but that can be acquired under the Materials Act of 1947, as amended.

mitigation measure: Actions taken to reduce or eliminate effects (impacts) from management actions, including 1) avoiding the impact altogether by not taking certain action or parts of an action; 2) minimizing impacts by limiting the degree or magnitude of the action and its implementation; 3) rectifying the impacts by repairing, rehabilitating, or restoring the affected environment; 4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and 5) compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

modification: A visual quality objective meaning activities by humans may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middle ground.

monitoring and evaluation: The evaluation, on a sample basis, of management practices to determine how well objectives are being met, as well as the effects of those management practices

on the land and environment.

montane: Inhabiting the cool, moist ecological zone located near the timberline and usually dominated by evergreen trees.

motor vehicle: Any vehicle that is self-propelled, other than a vehicle operated on rails and any wheelchair or mobility device, including those that are battery powered, that are designed solely for use by a mobility-impaired person for locomotion, and that are suitable for use in an indoor pedestrian area.

motor vehicle use map: A map reflecting designated roads, trails, and areas on an administrative unit or a Ranger District of the National Forest System.

motorized wheeled vehicle: Includes all types of motorized wheeled vehicles capable of or designed for travel on or immediately over land or other natural terrain (motorcycles, four-wheel drive vehicles, all-terrain vehicles, sport utility vehicles, pickup trucks, etc.) and includes those vehicles that have the driving wheels moving inside endless tracks or capable of conversion to such method of travel.

multiple use: The management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to changing needs and conditions; the use of some land for less than all of the resources; a combination of balanced and diverse resource uses that takes into account the long-term needs of future generations for renewable and nonrenewable resources, including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values; and harmonious and coordinated management of the various resources without permanent impairment of the productivity of the land and the quality of the environment with consideration being given to the relative values of the resources and not necessarily to the combination of uses that will give the greatest economic return or the greatest unit output.

National Environmental Policy Act of 1969 (NEPA): An act that encourages productive and enjoyable harmony between humans and their environment; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of people; enriches the understanding of the ecological systems and natural resources important to the nation; and establishes a Council on Environmental Quality; 40 CFR 1500–1508 are the regulations for implementing the act.

National Environmental Policy Act (NEPA) process: All measures necessary to comply with the requirements of Section 2 and Title 1 of the National Environmental Policy Act. An interdisciplinary process, mandated by the National Environmental Policy Act, which concentrates decision-making around issues, concerns, alternatives and the effects of alternatives on the environment.

National Forest Management Act (NFMA): A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of regional and forest plans and the preparation of regulations to guide that development.

National Forest System (NFS): All national forest lands reserved or withdrawn from the public domain of the United States; all national forest lands acquired through purchase, exchange, donation, or other means, the national grasslands and land utilization projects administered under Title 111.

National Forest System (NFS) road: A forest road other than a road that has been authorized by a legally documented right-of-way held by a state, county, or other local public road authority.

National Forest System (NFS) trail: A forest trail other than a trail that has been authorized by a legally documented right-of-way held by a state, county, or other local public road authority.

National Wild and Scenic Rivers System: A system of nationally designated rivers and their immediate environments that have outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, and other similar values and are preserved in a free-flowing condition. The system

consists of three types of streams: 1) recreation—rivers or sections of rivers that are readily accessible by road or railroad and that may have some development along their shorelines and may have undergone some impoundments or diversion in the past; 2) scenic—rivers or sections of rivers free of impoundments with shorelines or watersheds still largely undeveloped but accessible in places by roads; and 3) wild—rivers or sections of rivers free of impoundments and generally inaccessible except by trails, with watersheds or shorelines essentially primitive and waters unpolluted.

native fish: Fish species that are indigenous to a region's waters, as opposed to introduced or exotic fish.

native species: Species that normally live and thrive in a particular ecosystem.

naturalness: Refers to an area that "generally appears to have been affected primarily by the forces of nature, with, the imprint of man's work substantially unnoticeable" (Section 2[c] of the Wilderness Act of 1964).

NatureServe: A non-profit conservation organization that provides the scientific information and tools needed to help guide effective conservation actions. It represents an international network of biological inventories—known as natural heritage programs or conservation data center—operating in all 50 U.S. states, Canada, Latin America, and the Caribbean.

NatureServe conservation status rankings: A suite of factors that are used to assess the extinction or extirpation risk of plants, animals, and ecosystems. The three broad categories that factor into these rankings include rarity, trends, and threats. Global conservation status rankings include secure (G5), apparently secure (G4), vulnerable (G3), imperiled (G2), critically imperiled (G1), possibly extinct or eliminated (GH), and presumed extinct or eliminated (GX). The Colorado Natural Heritage Program provides a similar statewide conservation status rank (reported as "S" ranks).

net annual growth: The average net annual increase in the volume of trees during the period between inventories. Components include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus the net volume of trees reaching the minimum size class during the year, minus the volume of trees that died during the year, and minus the net volume of trees that became cull trees during the year.

No Action Alternative: The No Action Alternative is required by regulations implementing the National Environmental Policy Act (40 CFR 1502.14). The No Action Alternative provides a baseline for estimating the effects of other alternatives. Where a project activity is being evaluated, the No Action Alternative is defined as one where no action or activity would take place.

non-functional: Riparian areas that lack the soil, water, or vegetation attributes to function properly and that are highly susceptible to degradation.

non-functioning condition: 1) Condition in which vegetation and ground cover are not maintaining soil conditions that can sustain natural biotic communities; 2) riparian-wetland areas are considered to be in non-functioning condition when they do not provide adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, or other normal characteristics of riparian areas. The absence of a floodplain may be an indicator of non-functioning condition.

non-game species: Those species of animals that are not managed as a sport hunting resource.

non-point source pollution: Pollution whose source is not specific in location; the sources of the pollutant discharge are dispersed, not well defined, or constant. Examples include sediments from logging activities and runoff from agricultural chemicals.

not suitable for timber production: Forest land for which timber production is not a management objective (36 CFR 219.12 and Forest Service Manual 1921.12). These are lands where: 1.) statute, executive order, or regulation prohibits timber production on the land, or the Secretary of Agriculture or the Chief of the U.S. Forest Service have withdrawn the land from timber production; 2.) the land is not forest land; 3.) timber production would not be compatible with the achievement of desired

conditions and objectives established by the Land and Resource Management Plan for those lands; or 4) timber is generally not suitable for harvest.

nutrient cycling: This is a concept that describes how nutrients move from the physical environment into living organisms and subsequently are recycled back to the physical environment. This circular movement of nutrients is essential to any given ecosystem, and it must be balanced and stable for the systems to be maintained. There are many different nutrient cycles, each with its own particular pathways, but the most important are those involving the elements carbon, oxygen, nitrogen, and phosphorus.

noxious weeds: Plants designated as noxious by the Secretary of Agriculture or by the responsible state official. They are usually an invasive species. They generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, non-native, new, or not common to the United States. According to the Federal Noxious Weed Act (Public Law 93-639), a noxious weed is one that causes disease or has other adverse effects on people or their environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.

off-highway vehicle (OHV): Any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain. Travel on or immediately over land, water, or other natural terrain, excluding 1) any non-amphibious registered motorboat; 2) any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes; 3) any vehicle whose use is expressly authorized by the Authorized Officer, or otherwise officially approved; 4) vehicles in official use; and 5) any combat or combat support vehicle when used for national defense.

off-road: Any motorized travel that is not on the designated road and trail system.

old growth: Forest lands that meet the old growth descriptions for the Rocky Mountain Region as outlined in Mehl (1992). Old growth forests represent the late stages of forest development and are primarily distinguished by old trees, large trees, snags, and large wood on the forest floor.

The criteria used for determining old growth forests on the San Juan National Forest and Tres Rios Field Office are based on the Rocky Mountain Regional Guidelines (with slight modifications), which are documented in a publication called *Old-Growth Forests in the Southwest and Rocky Mountain Regions Proceedings of a Workshop*, March 9–13, 1992 Portal, Arizona, General Technical Report RM-213. The criteria for each cover type are as follows:

- **Ponderosa pine old growth:** Age ≥ 200; diameter at breast height ≥ 16 inches; large trees per acre (≥ 16 inches diameter at breast height) ≥10; rot + dead/broken tops per acre ≥1; and snags (10 inches min diameter at breast height) ≥2
- **Mixed conifer old growth:** Age ≥ 200; diameter at breast height ≥ 16 inches; large trees per acre (≥ 16 inches diameter at breast height) ≥10; rot + dead/broken tops per acre ≥1; snags (10 inches min diameter at breast height) ≥2; and layers ≥2
- **Spruce/fir old growth:** Age ≥ 200; diameter at breast height ≥ 16 inches; large trees per acre (≥ 16 inches diameter at breast height) ≥10; rot + dead/broken tops per acre ≥1; snags (10 inches min diameter at breast height) ≥2; and layers ≥2
- **Aspen Seral:** Age ≥ 100; diameter at breast height ≥ 14 inches; large trees per acre (≥ 14 inches diameter at breast height) ≥10; rot + dead/broken tops per acre ≥1; and understory of conifer present (Note: aspen is considered seral old growth if the stand meets the criteria and there is conifer in the understory. It is considered climax old growth if the stand meets the criteria and there is no conifer in the understory.)
- **Aspen Climax:** Age ≥ 100; diameter at breast height ≥ 14 inches; large trees per acre (≥ 14 inches diameter at breast height) ≥10 ; rot + dead/broken tops per acre ≥1; and understory of conifer absent
- **Pinyon-Juniper:** Age ≥ 200; diameter at root crown ≥ 12 inches; large trees per acre (≥ 12

inches diameter at root crown) ≥30; rot + dead/broken tops per acre ≥1; and snags (10 inches min diameter at root crown) ≥1

open (Bureau of Land Management): Designated areas and trails where off-road vehicles may be operated, subject to operating regulations and vehicle standards set forth by land management agencies; or an area where all types of vehicle use is permitted at all times, subject to the standards set forth by land management agencies.

organic soils: A soil that contains greater than 20% organic matter throughout the solum.

outstanding waters: An outstanding waters designation offers the highest level of water quality protection available under the Clean Water Act and Colorado regulations. This designation is designed to prevent any degradation from existing conditions.

outstandingly remarkable values (ORVs): Values among those listed in Section 1(b) of the Wild and Scenic Rivers Act: “scenic, recreational, geological, fish and wildlife, historical, cultural, or other similar values…” Other similar values that may be considered include ecological, biological or botanical, paleontological, hydrological, scientific, or research values (from M-8351, Bureau of Land Management Wild and Scenic Rivers Policy and Program).

ozone (O_3): A faint blue gas produced in the atmosphere from chemical reactions of such sources as burning coal, gasoline and other fuels, and chemicals found in products including solvents, paints, hairsprays, etc.

paleontological resource: The Omnibus Public Lands Act of 2009 defines the term “paleontological resource” as any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth, except that the term does not include—
1) any materials associated with an archaeological resource (as defined in Section 3(1) of the Archaeological Resources Protection Act of 1979 [16 USC 470bb(1)], or 2) any cultural item (as defined in Section 2 of the Native American Graves Protection and Repatriation Act [25 USC 3001]).

perennial stream: Perennial streams carry flowing water continuously throughout the year, regardless of weather conditions. They exhibit well-defined geomorphological characteristics and in the absence of pollution, thermal modifications, or other human-made disturbances have the ability to support aquatic life. During hydrological drought conditions, the flow may be impaired.

Season-long grazing: Livestock grazing that occurs over the entire permitted season of use.

permitted livestock: Livestock presently being grazed under a permit or those that were grazed under a permit during the preceding season, including their offspring retained for herd replacement.

permitted use (Bureau of Land Management): The forage allocated by, or under the guidance of, an applicable land use plan for livestock grazing in an allotment under a permit or lease, and is expressed in animal unit months (AUMs) (43 CFR 4100.0-5) (from H-4180-1, Bureau of Land Management Rangeland Health Standards Manual).

permitted use (U.S. Forest Service): The number of animals, period of use, and location of use specified in Part 1 of the grazing permit.

plan amendment: The system that provides a step-by-step process for considering multiple resource values, resolving conflicts, and making resource management decisions.

phytoplankton: Minute floating plants, usually algae, distributed throughout a body of water as deep as light penetrates.

planning criteria: The factors used to guide development of the resource management plan, or revision, to ensure that it is tailored to the issue previously identified and to ensure that unnecessary data collection and analysis are avoided. Planning criteria are developed to guide the collection and use of inventory data and information, analysis of the management situation, design and formulation of alternatives, estimation of the effects of alternatives, evaluation of alternatives, and selection of the

preferred alternative.

planning horizon: The overall time period that spans all activities covered in the Land and Resource Management Plan and all future conditions and effects of proposed actions that would influence the planning decisions. This is typically considered 50 years.

population: Organisms of the same species that occur in a particular place at a given time. In statistics, the aggregate of all units forming the subject of study; otherwise, a community of individuals that share a common gene pool.

potential conservation area (PCA): Colorado Natural Heritage Program’s term used as a planning tool to delineate a geographic area focused on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance.

potential natural vegetation: The stable vegetation community that could occupy a site under current climatic conditions without further influence by humans. Often used interchangeably with “potential natural community.”

preferred alternative: The agency’s preferred alternative, one or more, that is identified in the environmental impact statement (40 CFR 1502.14).

prescribed burning: The intentional application of fire to wildland fuels in either their natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, reduction of fuel hazard, etc.).

prescribed fire: A fire purposely ignited to meet specific objectives (see prescribed burning).

prevention of significant deterioration (PSD): An air pollution-permitting program intended to ensure that air quality does not diminish in attainment areas.

primary succession: The establishment and subsequent changes in a community from newly formed habitats without plants (e.g., sand dunes, lava flows, or newly exposed rock). Involves much modification of the environment by early colonists, i.e., pioneer species (such as lichens and mosses, beach grasses), which, in terrestrial environments, stabilize and enrich or even generate soil.

primitive and unconfined recreation: Non-motorized, non-mechanized (except as provided by law), and undeveloped types of recreational activities. Bicycles are considered mechanical transport.

productivity: The capacity of National Forest Service lands and their ecological systems to provide the various renewable resources in certain amounts in perpetuity (36 CFR 219.16).

programmatic environmental impact statement: An environmental impact statement that establishes a broad management direction for an area by establishing a goal, objective, standard, management prescription and monitoring and evaluation requirement for different types of activities that are permitted. It also can establish what activities are not permitted within the specific area(s). This document does not mandate or authorize the permitted activities to proceed.

project: The whole of an action, which has the potential for resulting in a physical change in the environment.

project area: The geographic area defining the scope of this document and the alternatives proposed by it.

project file: An assemblage of documents that contains all the information developed or used during an environmental analysis. This information may be summarized in an Environmental Assessment or an Environmental Impact Statement. The project file becomes part of the administrative record for judicial review in case of legal action.

proper functioning condition: 1) An element of the Fundamental of Rangeland Health for watersheds, and therefore a required element of state or regional standard and guidelines under 43 CFR 4180.2(b); 2) condition in which vegetation and ground cover maintain soil conditions that can

sustain natural biotic communities; 3) riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality, filter sediment, capture bedload, and aid floodplain development; improving floodwater retention and groundwater recharge; developing root masses that stabilize stream banks against cutting action; developing diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and supporting greater biodiversity (the functioning condition of riparian-wetland areas is influenced by geomorphic features, soil, water, and vegetation); 4) uplands function properly when the existing vegetation and ground cover maintain soil conditions capable of sustaining natural biotic communities. The functioning condition of uplands is influenced by geomorphic features, soil, water, and vegetation.

proposed action: For a special use permit, a description of the project as proposed by the project proponent in the Special Use Permit application.

protected areas: Large, mostly unaltered, undeveloped, and unroaded lands dedicated to the protection and maintenance of biological diversity (International Union for Conservation of Nature 1994).

Bureau of Land Management lands: Any land or interest in land owned by the United States and administered by the Secretary of the Interior through the Bureau of Land Management.

public scoping: Giving the public the opportunity for free, unhampered, speaking or writing concerning the intentions, activity, or influence of a project on the community and environment.

range analysis: Systematic acquisition and evaluation of rangeland resource data needed for allotment management planning and overall land management.

range improvement: An authorized physical modification or treatment that is designed to improve production of forage, change vegetation composition, control patterns of use, provide water, stabilize soil and water conditions, and restore, protect, and improve the condition of rangeland ecosystems to benefit livestock, wild horses and burros, and fish and wildlife. The term includes, but is not limited to, structures, treatment projects, and use of mechanical devices or modifications achieved through mechanical means (43 CFR 4100).

rangelands: Lands that produce or are capable of producing forage for grazing and browsing animals. They include grasslands, forblands, shrublands, and forested lands.

rangeland condition: The present state of a rangeland relative to the potential of that rangeland, usually associated with the composition, abundance, and distribution of plant species relative to the potential natural community for that rangeland.

Ranger District: An administrative subdivision of the National Forest System, supervised by a District Ranger who reports to the Forest Supervisor.

reasonable foreseeable development (RFD) scenario: The prediction of the type and amount of oil and gas activity that would occur in a given area. The prediction is based on geologic factors, past history of drilling, projected demand for oil and gas, and industry interest.

reclamation: Returning disturbed land to a form and productivity that will be ecologically balanced and in conformity with a predetermined land management plan.

Record of Decision (ROD): A concise public document disclosing the decision made following preparation of an environmental impact statement and the rationale used to reach that decision.

Recreation and Public Purposes Act of 1926: The Recreation and Public Purposes Act provided for the lease and sale of public lands determined valuable for public purposes. The objective of the act is to meet the needs of state and local government agencies and non-profit organizations by leasing or conveying public land required for recreation and public purpose uses. Examples of uses made of Recreation and Public Purposes Act lands are parks and greenbelts, sanitary landfills, schools, religious facilities, and camps for youth groups. The act provides substantial cost benefits for

land acquisition and provides for recreation facilities or historical monuments at no cost.

recreation experiences: Psychological outcomes realized either by recreation-tourism participants as a direct result of their on-site leisure engagements and recreation-tourism activity participation or by non-participating community residents as a result of their interaction with visitors and guests within their community and/or interaction with public land (Bureau of Land Management/U.S. Forest Service) and other public and private recreation-tourism providers and their actions.

recreation management zones (RMZs): Sub-units within a Special Recreation Management Area managed for distinctly different recreation products. Recreation products are composed of recreation opportunities, the natural resource and community settings within which they occur, and the administrative and service environment created by all affecting recreation-tourism providers within which recreation participation occurs.

recreation niche: The place or position within the strategically targeted recreation-tourism market for each Special Recreation Management Area that is most suitable (i.e., capable of producing certain specific kinds of recreation opportunities) and appropriate (i.e., most responsive to identified visitor or resident customers), given available supply and current demand, for the production of specific recreation opportunities and the sustainable maintenance of accompanying natural resource and/or community setting character.

recreation opportunities: Favorable circumstances enabling visitors' engagement in a leisure activity to realize immediate psychological experiences and attain more lasting, value-added beneficial outcomes.

Recreation Opportunity Spectrum (ROS): The ROS offers a framework to establish the desired setting conditions of access, remoteness, naturalness, built environment, social encounters, visitor impacts, and management for all areas of the San Juan National Forest and Tres Rios Field Office. These conditions are shown on the Established ROS Settings Map.

- Projects and activities shall be consistent with the established ROS settings. Because this map shows broad desired setting conditions for the entire planning area, site-specific analysis is generally necessary to further refine desired setting conditions that may apply to site-specific projects.
- Pristine areas provide outstanding opportunity for solitude, natural quiet, and isolation; sights and sounds of development do not intrude on the experience. Lands are managed to protect and perpetuate their pristine conditions. Encounters with others are rare. All travel is cross-country. There is no lasting evidence of camping activity, social trails, or other human impacts. Indirect methods of accomplishing management objectives predominate.
- Primitive areas are an essentially unmodified natural environment. These areas offer a moderate degree of solitude and natural quiet, and are managed to allow natural ecological change to occur uninterrupted. Human influence on vegetation is minimal. There may be evidence of campsites. Campsites are dispersed; usually one will not hear or see visitors at adjacent campsites. Maintained trails exist and user-established trails are evident. Evidence of management is minor.
- Semi-primitive areas are managed to protect the natural environment and provide access to primitive or pristine areas. Encounters with other users may be frequent in some concentrated use areas. Constructed and maintained trails support access to popular destinations. Use is often heavily concentrated day use; however, overnight camping occurs. Management emphasizes sustaining and protecting natural conditions. Management actions to mitigate visitor use impacts may be noticeable. Human use and activities within the area may be evident.
- **Semi-primitive non-motorized** non-wilderness backcountry areas are characterized by a quiet, predominantly natural-appearing environment. Resource modification and utilization practices are not evident. Recreation opportunities are primarily those that provide opportunities for self-reliance and challenge. Concentrations of users are low. Common recreation activities include hiking, mountain biking, hunting, fishing, backpacking, and camping.

- **Semi-primitive motorized** landscapes are similar in naturalness to semi-primitive non-motorized landscapes with motorized travel. Travel is over designated trails or high-clearance, four-wheel drive roads. Roads are designed primarily for low speeds and with native surfacing. Road and trail density provide for a sense of remoteness and solitude. Common recreation activities include motorized trail riding, four-wheel driving, visiting cultural sites, hunting, fishing, and dispersed camping.
- **Roaded natural** lands are generally high use travel corridors with a high level of visitor services and associated development. Concentrations of users can be moderate to high. The areas often take on a mosaic of development and resource evidence from highly modified areas to pockets of unmodified lands. Conventional motorized use is provided for in construction standards such as road widths and surface hardening. Road development levels are native surfaced high-clearance to levels that will accommodate passenger vehicles. Off-highway vehicle travel is common on forest roads and trails. Road and trail densities are moderate to high and interaction with the other users is to be expected. Developed campgrounds, picnic areas, trailhead, and interpretive sites may be present within this setting. Constructed recreation facilities provide for resource protection, visitor information and comfort. Hunting, fishing, biking, hiking, and viewing scenery are common activities.
- **Rural** areas are substantially modified, although they may have natural-appearing elements. Facilities are almost always designed for a large number of people and roads are generally paved. Rural areas are characterized by substantially modified natural environment. The landscape is often dominated by human-caused geometric patterns; there is also a dominant sense of open, green-space. Development of facilities is for user comfort such as pavement on roads and trails, and convenience amenities within campgrounds. Common facilities within this setting would be visitor centers, developed campgrounds that provide electricity and showers, areas with multiple facility developments such as lodges, campgrounds, and recreation residences. Driving for pleasure, viewing scenery and cultural features, camping, and picnicking are common activities.

recreation settings: The collective, distinguishing attributes of landscapes that influence, and sometimes actually determine, what kinds of recreation opportunities are produced.

recreation setting character conditions: The distinguishing recreational qualities of any landscape, objectively defined along a continuum ranging from primitive to urban landscapes, expressed in terms of the nature of the component parts of its physical, social, and administrative attributes. These recreational qualities can be both classified and mapped. This classification and mapping process should be based on variation that either exists (i.e., setting descriptions) or is desired (i.e., setting prescriptions) among component parts of the various physical, social, and administrative attributes of any landscape. The Recreation Opportunity Spectrum is one of the existing tools for doing this.

recreation-tourism market: Recreation-tourism visitors, affected community residents, affecting local governments and private sector businesses, or other constituents and the communities or other places where these customers originate (local, regional, national, or identify primary recreation-tourism markets for each Special Recreation Management Area).

recreation visitor days: One 12-hour period of recreation. It can be one person for 12 hours, two people for 6 hours, 12 people for 1 hour, etc.

reference period: The period of indigenous settlement from about 1500 to the late 1800s. It is a time when broad-scale climatic conditions were similar to those of today, but Euro-American settlers had not yet introduced the sweeping ecological changes (including timber harvest, livestock grazing, fire suppression, water diversions, dams, and roads) that have greatly altered many Rocky Mountain landscapes.

recreational river: Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

remnant plant species: A remnant or fragment of the vegetation of an area that remains from a former period when the vegetation was more widely distributed.

resilient: The capability to withstand or recover from disturbance or change.

resource management plan (RMP): A Bureau of Land Management planning document, prepared in accordance with Section 202 of the Federal Land Policy and Management Act, that establishes, for a given area of land, land use allocations, coordination guidelines for multiple use, objectives, and actions to be achieved. It presents systematic guidelines for making resource management decisions for a planning area. An RMP is based on an analysis of an area's resources, existing management, and capability for alternative uses. RMPs are issue oriented and developed by an interdisciplinary team with public participation.

restoration: The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. It is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity, and sustainability.

rest rotation grazing: A grazing management scheme in which rest periods for individual pastures, paddocks, or grazing units, generally for the full growing season, are incorporated in a grazing rotation

restricted road: A National Forest System road or segment that is restricted from a certain type of use or all uses during certain seasons of the year or yearlong. The use being restricted and the time period must be specified. The closure is legal when the Forest Supervisor has issued an order and posted that order in accordance with 36 CFR 261.

revegetation: The reestablishment and development of a plant cover. This may take place naturally through the reproductive processes of the existing flora, or artificially through the direct action of reforestation or reseeding.

right-of-way (ROW): The public lands authorized to be used or occupied for specific purposes pursuant to a ROW grant, which are in the public interest and which require ROWs over, upon, under, or through such lands.

riparian: A type of ecological community that occurs adjacent to streams and rivers. It is characterized by certain types of vegetation, soils, hydrology, and fauna and requires free or unbound water or conditions more moist than that normally found in the area.

riparian area: A form of wetland transition between permanently saturated wetlands and upland areas. Riparian areas exhibit vegetation or physical characteristics that reflect the influence of permanent surface or subsurface water. Typical riparian areas include lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels. Excluded are ephemeral streams or washes that lack vegetation and depend on free water in the soil.

road: A motor vehicle route over 50 inches wide, unless identified and managed as a trail that has been improved and maintained by mechanical means to ensure relatively regular and continuous use. (A way maintained strictly by the passage of vehicles does not constitute a road.)

roadless: Refers to the absence of roads that have been constructed and maintained by mechanical means to ensure regular and continuous use.

roadless area: A National Forest System area that: 1) is larger than 5,000 acres, or if smaller than 5,000 acres, contiguous to a designated wilderness or primitive area; 2) contains no roads; and 3) has been inventoried for possible inclusion in the wilderness preservation system.

Roadless Area Review and Evaluation (RARE II): Roadless areas inventoried in the second roadless area review and evaluation (36 CFR 219.17).

rock art: Petroglyphs (carvings) or pictographs (painting) used by native persons to depict their history and culture.

rotation: The number of years (including the regeneration period) required to establish and grow timber crops to a specified condition or maturity under even-aged management. Selected integrated

prescriptions in the land management plan provide the basis for the rotation age. This is used to calculate the contribution to long-term sustained-yield capacity for the Land and Resource Management Plan area from lands suitable for timber production.

rotation age: The period of years between when a forest stand (i.e., primarily even-aged) is established (i.e., regeneration) and when it receives its final harvest. This time period is an administrative decision based on economics, site condition, growth rates, and other factors.

rotation grazing: A component of grazing systems that require two or more pastures between which grazing animals are moved in sequence resulting in grazing periods being followed by non-grazing periods (Vallentine 1990).

routes: A combination of roads, trails, or ways that are used by motorized vehicles (including jeeps, all terrain vehicles, motorized dirt bikes, etc.), mechanized uses and mechanical transport (mountain bikes, wheelbarrows, game carts), pedestrians (hikers), and/or equestrians (horseback riders).

satisfactory rangeland conditions: Rangelands are considered to have satisfactory rangeland conditions if current conditions are meeting or moving toward the desired conditions identified in an allotment management plan or in a land health determination. Desired conditions in an allotment management plan or land health determination are developed using Bureau of Land Management Colorado Public Land Health Standards (Bureau of Land Management 1997) and/or the Rangeland Analysis and Management Training Guide (Rocky Mountain Region 1996), respectively.

scenic byways: Highway routes, which have roadsides or corridors of special aesthetic, cultural, or historic value. An essential part of the highway is its scenic corridor. The corridor may contain outstanding scenic vistas, unusual geologic features, or other natural elements.

- Scenic attractiveness is a measure of the landscape’s scenic importance based on common human perceptions of the intrinsic scenic beauty of landforms, rock forms, water forms, vegetation patterns, and cultural features. There are three levels of inherent scenic attractiveness that classify the scenic quality of natural landscapes.
- **Class A - Distinctive**: areas where features of landform, vegetative patterns, water forms and rock formation are of unusual or outstanding scenic quality.
- **Class B - Common**: areas where features contain variety in form, line, color and texture or combinations thereof but tend to be common throughout the landscape province and are not outstanding scenic quality.
- **Class C - Undistinguished**: areas whose features have little change in form, line, color, or texture. Includes all areas not found under Classes A and B.
- Scenic sustainability is a measure of the degree to which the ecosystem is likely able to restore, maintain, or continue to exhibit the positive dominant attributes of the landscape character. It is a continuum that ranges from high to low. High scenic sustainability is a prediction that all positive dominant attributes of the landscape character are perpetuated (during the planning period), moderate is a prediction that there is some loss of attributes, and low is the loss of most or all attributes.
- Scenic integrity is a measure of the lack of noticeable human-caused disturbance in the area that detracts from the dominant, valued attributes of landscape character. The baseline from which to measure scenic integrity is dependent on a complete and accurate description of the important and dominant positive landscape character attributes that are viewed at the time of measurement. It can be used to describe scenery in the past, as it presently exists, and as predicted in the future. Scenic integrity is a continuum that ranges from very high to low. Landscapes with a high degree of scenic integrity have virtually no discordant elements and contain only positive human alterations. They are intact, unimpaired and appear to be in good visual condition. On the opposite end of the continuum, landscapes with low scenic integrity usually have negative human alterations and are in poor visual condition. They often contain discordant and contrasting features such as geometric shapes resulting from vegetative

treatment, structures that do not blend with their surroundings, or roads that create large cut and fill slopes across steep hillsides.

Scenic Integrity Levels:

- **Very High** – refers to landscapes where the valued landscape character “is” intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.
- **High** – refers to landscapes where the valued landscape character “appears” intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
- **Moderate** – refers to landscapes where the valued landscape character “appears slightly altered.” Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low** – refers to landscape where the valued landscape character “appears moderately altered.” Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.
- **Very Low** – refers to landscapes where the valued landscape character “appears heavily altered.” Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles within or outside the landscape being viewed. However deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the compositions.

scenic river: A river or section of a river that is free of impoundments and whose shorelines are largely undeveloped but accessible in places by roads.

scoping: The procedures by which the U.S. Forest Service and the Bureau of Land Management determine the extent of analysis necessary for a proposed action, i.e., the range of actions, alternatives, and impacts to be addressed, identification of significant issues related to a proposed action, and establishing the depth of environmental analysis, data, and task assignments needed.

scrubland: Areas dominated by woody shrubs. These areas include sagebrush, salt desert shrub, and mountain shrub vegetation types.

season of use: The time during which livestock are permitted on a given range area, i.e., grazing allotment, as specified in the grazing permit or lease. Synonymous with “grazing season.”

seasonal closure: A temporary closure of an area or road for a part of the year.

Section 404 permit: A permit issued by the U.S. Army Corps of Engineers, as dictated in Section 404 of the Clean Water Act, that specifies that anyone wishing to place dredged or fill materials into the waters of the U.S. and adjacent jurisdictional wetlands shall apply to the U.S. Army Corps of Engineers for approval.

secondary succession: Results from changes in an area that previously had a vegetation community where disturbance (i.e., surface disturbance, insect pest or disease) reset the stage of the community to an earlier point in the succession process but did not reset it to the primary succession stage.

sediment: Material suspended in liquid or air. Any material carried in suspension by water, which will ultimately settle to the bottom. Sediment has two main sources: from the channel area itself and from disturbed sites.

self-sustaining population: A population of organisms that has appropriate characteristics, including the abundance and distribution of individuals of the population, to provide for its long-term persistence.

semiarid: Moderately dry; region or climate where moisture is normally greater than under arid conditions but still definitely limits the production of vegetation.

sensitive species: A plant or animal listed by a state or federal agency as being of environmental concern that includes, but is not limited to, threatened and endangered species.

sensitivity level: A particular degree or measure of viewer interest in the scenic qualities of the landscape.

seral: The stage of succession of a plant community that is transitional. If left alone, the seral stage will give way to another plant community that represents a further stage of succession.

severe winter range: Areas within the winter range where 90% of the individuals are located when annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten.

shrub: A plant with persistent woody stems and relatively low growth form; usually produces several basal shoots as opposed to a single bole; differs from a tree by its low stature and non-arborescent form.

significant: As used in the National Environmental Policy Act, requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts, such as society as a whole and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

significant effect: A substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, water, minerals, flora, fauna, and objects of historic or aesthetic significance.

silvicultural system: A planned series of treatments for tending, harvesting, and re-establishing a stand. The system name is based on the number of age classes (coppice, even-aged, two-aged, uneven-aged) or the regeneration method (clearcutting, seed tree, shelterwood, selection, coppice) used.

snag: A standing dead tree.

soil quality: The capacity of a specific kind of soil to function within natural or managed ecosystem boundaries, sustain plant and animal productivity, maintain or enhance the quality of water and air, and support human health and habitation (Natural Resources Conservation Service 2001).

soil productivity: The inherent capacity of a soil to support the growth of specified plants or plant communities.

Special Recreation Management Area (SRMA): A public lands unit identified in land use plans to direct recreation funding and personnel to fulfill commitments made to provide specific, structured recreation opportunities (i.e., activity, experience, and benefit opportunities). The Bureau of Land Management recognizes three distinct types of SRMAs: community-based, intensive, and undeveloped big open (H-1601-1, Bureau of Land Management Land Use Planning Handbook).

special-status species: Collectively, federally listed species, species proposed for federal listing, candidates for federal listing, Region 2 Regional Forester’s sensitive species, and Colorado Bureau of Land Management State Director’s sensitive species.

Special Use Permit: A permit issued under established laws and regulations to an individual, organization, or company for occupancy or use of National Forest System lands for some special purpose.

species: Any member of the currently accepted and scientifically defined plant or animal kingdoms of

organisms (U.S. Forest Service 2005). A unit of classification of plants and animals consisting of the largest and most inclusive array of sexually reproducing and cross-fertilizing individuals which share a common gene pool.

species of concern: Species for which the Responsible Official determines that management actions may be necessary to prevent listing under the Endangered Species Act.

species of interest: Species for which the Responsible Official determines that management actions may be necessary or desirable to achieve ecological or other multiple-use objectives.

stand: A vegetation community sufficiently uniform in composition, age, spatial arrangement, or condition to be distinguishable from an adjacent vegetation community.

standard: A particular action, level of performance, or threshold specified by the Forest Plan for resource protection or accomplishment of management objectives. Unlike “guidelines” which are optional, standards specified in the Forest Plan are mandatory.

State Implementation Plan: A detailed description of the programs a state will use to carry out its responsibilities under the Clean Air Act. State implementation plans are collections of the regulations used by a state to reduce air pollution.

stocking: The degree to which trees occupy the land, measured by basal area or the number of trees per given area.

Stocking rate: Acres of suitable rangeland required to support one animal unit month. In the western United States generally expressed as acres/animal unit month.

structure: The horizontal and vertical distribution of components in a vegetation community, including the height, diameter, crown layers, and stems of the plants, and the amount and arrangement of snags and down woody material.

subalpine: A terrestrial community that generally is found in harsher environments than the montane terrestrial community. Subalpine communities are generally colder than montane and support a unique clustering of wildlife species.

succession: The progressive replacement of plant communities on a site that leads to the potential natural community.

suitability: The appropriateness of a particular area of land for applying certain resource management practices, as determined by an analysis of the existing resource condition of that land. A unit of land may be suitable for a variety of management practices.

suitable habitat: Habitat that currently has the attributes needed for a given species.

sustainability: Obtaining yields and services from ecosystems without irreversibly affecting their resilience, natural resistance to change, or ability to meet the needs of future generations.

summer range: A range, usually at higher elevation, used by deer and elk during the summer; a summer range is usually much more extensive than a winter range.

sustained yield: Sustained yield of wood fiber that properly harvested and mitigated, would sustain the underlying ecosystem processes.

take: To harass, harm, pursue, hunt, shoot, kill, trap, capture, or collect a species listed under the Endangered Species Act, or to attempt to engage in any such conduct.

taxonomic orders: The sequence in listing of “taxa” which aids ease of use and roughly reflects the evolutionary relationships among the “taxa” (i.e., families, genera, species, etc.).

temporary road or trail: A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a forest transportation atlas.

terrestrial ecosystem: Ecosystems that occur in relatively dry, upland landscape positions.

thermal cover: Vegetation used by animals to modify the adverse effects of weather. A forest stand that is at least 40 feet in height with tree canopy cover of at least 705 provides thermal cover. These stand conditions are achieved in closed sapling-pole stands and by all older stands unless the canopy cover is reduced below 70%. deciduous stands may serve as thermal cover in summer, but not in winter.

threatened species: Any species likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been designated in the *Federal Register* by the Secretary of the Interior as such (Forest Service Manual 2670.5).

tiering: The use of a previously written environmental document with a broad scope to cover discussion of issues common to both.

timber harvest: The removal of trees for wood fiber use and other multiple-use purposes.

timber production: The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use (36 CFR 219.16).

timber sale program quantity (TSPQ): The estimated output of timber from the planning area. The estimate is displayed as an average annual cubic foot output for a decade. It includes projected outputs from lands generally suitable for timber harvest. The projected timber outputs reflect past and projected budget levels and organizational capacity to achieve the desired conditions and objectives in the Land and Resource Management Plant (36 CFR 219.12 and Forest Service Manual 1921.12).

total maximum daily load (TMDL): An estimate of the total quantity of pollutants (from all sources: point, non-point, and natural) that may be allowed into waters without exceeding applicable water quality criteria.

total tree timber harvest: A timber harvest method that removes the whole tree, including the tree top and all its branches.

traditional cultural property: A property that derives significance from traditional values associated with it by a social and/or cultural group such as an Indian tribe or local community. A traditional cultural property may qualify for the National Register of Historic Places if it meets the criteria and criteria exceptions at 36 CFR 60.4. See National Register Bulletin 38.

trail: A route 50 inches or less in width or a route over 50 inches wide that is identified and managed as a trail.

tribe: Term used to designate a federally recognized group of American Indians and their governing body. Tribes may be composed of more than one band.

unauthorized road or trail: A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas.

understory: Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

undertaking: A term with legal definition and application i.e., “actions carried out by or on behalf of the agency; those carried out with Federal financial assistance; those requiring a Federal permit, license, or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a federal agency.” (See National Historic Preservation Act, Section 106 and Section 301(7), Appendix 5; 36 CFR Part 800).

undeveloped recreation-tourism market: National, regional, and/or local recreation tourism visitors, communities, or other constituents who value public lands for the distinctive kinds of dispersed recreation produced by the vast size and largely open, undeveloped character of their recreation settings. Major investments and facilities are excluded within Special Recreation Management Areas where the strategy is to target demonstrated undeveloped recreation-tourism market demand. Here,

recreation management actions are geared toward meeting primary recreation-tourism market demand to sustain distinctive recreation setting characteristics; however, major investments in visitor services are authorized both to sustain those distinctive setting characteristics and to maintain visitor freedom to choose where to go and what to do—all in response to demonstrated demand for undeveloped recreation.

upland: The portion of the landscape above the valley floor or stream.

uneven-aged management: Actions resulting in the creation of stands in which trees of different ages grow together. Cutting is usually regulated by specifying the number or proportion of trees of particular size to retain within each cut area, thereby maintaining a planned distribution of size classes.

ungulate: A hoofed mammal such as a deer, elk, horse, sheep, or cow.

valid existing rights: Any lease established (and valid) prior to a new authorization, change in land designation, or in regulation.

viable populations: A wildlife population of sufficient size to maintain its existence over time in spite of normal fluctuations in population levels.

visibility (air quality): A measurement of the ability to see and identify objects at different distances.

visitor day: Twelve visitor hours, which may be aggregated by one or more persons in single or multiple visits.

visitor use: Visitor use of a resource for inspiration, stimulation, solitude, relaxation, education, pleasure, or satisfaction.

Visual Quality Objective (VQO): A system of indicating the potential expectations of the visual resource by considering the frequency an area is viewed and the type of landscape.

- **Maximum Modification:** A Visual Quality Objective meaning human activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.
- **Modification:** A Visual Quality Objective meaning human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middle ground.
- **Partial Retention:** A Visual Quality Objective that, in general, means human activities may be evident but must remain subordinate to the characteristic landscape.
- **Preservation:** A Visual Quality Objective that provides for ecological change only.
- **Retention:** A Visual Quality Objective that, in general, means human activities are not evident to the casual forest visitor.

visual resource: The visible physical features of a landscape (topography, water, vegetation, animals, structures, and other features) that constitute the scenery of an area.

Visual Resource Inventory (VRI) classes: For Bureau of Land Management lands, scenic conditions and anticipated effects are measured using the VRI Class.

- VRI classes are assigned through the inventory process. These are generally assigned based on a combination of scenic quality, sensitivity level, and distance zones. Inventory classes are informational in nature and provide the basis for considering visual values in the resource management plan process. They do not establish management direction and should not be used as a basis for constraining or limiting surface disturbing activities.

Visual Resource Management (VRM): The system by which Bureau of Land Management classifies and manages scenic values and visual quality of public lands. The system is based on research that

has produced ways of assessing aesthetic qualities of the landscape in objective terms. After inventory and evaluation, lands are given relative visual ratings (see definition for Visual Resource Management classes), which determine the amount of modification allowed for the basic elements of the landscape.

Visual Resource Management (VRM) classes: VRM classes define the degree of acceptable visual change within a characteristic landscape. A class is based on the physical and sociological characteristics of any given homogeneous area and serves as a management objective. Categories assigned to public lands based on scenic quality, sensitivity level, and distance zones. Each class has an objective, which prescribes the amount of change allowed in the characteristic landscape.

- **VRM Class I Objective**: To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention.
- **VRM Class II Objective**: To retain the existing character of the landscape. The level of change to the characteristic landscape should be low.
- **VRM Class III Objective**: To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
- **VRM Class IV Objective**: To provide for management activities that requires major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

volatile organic compounds (VOCs): Volatile organic chemicals that produce vapors readily, at room temperature and normal atmospheric pressure. Volatile organic chemicals include gasoline, industrial chemicals such as benzene, solvents such as toluene and xylene, and tetrachloroethylene (perchloroethylene, the principal dry cleaning solvent).

water quality: The biological, physical, and chemical properties of water that make it suitable for specific uses.

water use and disposal management plan: a comprehensive document that addresses the anticipated sources, quality, quantity, delivery, handling, storage, and disposal of both water utilized and wastewater generated during the various phases of project activities associated with fluid and solid mineral development. For wastewater, the expected locations and methods of disposal, treatment, and/or reuse that will be utilized during the life of the project shall also be included.
The water use and disposal management plan must provide adequate information for the agency to complete site-specific the National Environmental Policy Act analysis and to ensure compliance with all state and federal requirements prior to approval, and the operator is required to perform all project activities in conformance with this plan.

watershed: The entire land area that contributes water to a particular drainage system or stream.

wetlands: Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, etc.

whirling disease: This disease is caused by a myxosporean parasite that afflicts juvenile fish (fingerlings and fry) and causes skeletal deformities and neurological damage. Fish with this disease “whirl” forward in an awkward corkscrew-like pattern of swimming, find feeding difficult, and are more vulnerable to predators.

Wild and Scenic Study River (WSR): Rivers identified in Section 5 of the Wild and Scenic Rivers Act for study as potential additions to the National Wild and Scenic Rivers System.

wild river: Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Wild, Scenic, and/or Recreational: The term used in this Manual Section for what is traditionally shortened to “Wild and Scenic” rivers. Designated river segments are classified, i.e., wild, scenic, and/or recreational, but cannot overlap (from M-8351, Bureau of Land Management Wild and Scenic Study Rivers Policy and Program).

wilderness: A congressionally designated area of undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, that is protected and managed to preserve its natural conditions and that: 1) generally appears to have been affected mainly by the forces of nature, with human imprints substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least 5,000 acres or is large enough to make practical its preservation and use in an unimpaired condition; and 4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value. The definition contained in Section 2(c) of the Wilderness Act of 1964 (78 Stat. 891).

wilderness characteristics: Wilderness characteristics include size, the appearance of naturalness, outstanding opportunities for solitude, or a primitive and unconfined type of recreation. They may also include ecological, geological, or other features of scientific, educational, scenic, or historical value. However Section 2(c) of the Wilderness Act of 1964 has been updated by Instruction Memorandum 2003-195, dated June 20, 2003. Indicators of an area’s naturalness include the extent of landscape modifications, the presence of native vegetation communities, and the connectivity of habitats. Outstanding opportunities for solitude or primitive and unconfined types of recreation may be experienced when the sights, sounds, and evidence of other people are rare or infrequent, in locations where visitors can be isolated, alone or secluded from others, where the use of the area is through non-motorized, non-mechanical means, and where no or minimal developed recreation facilities are encountered.

wilderness study area (WSA): A designation made through the land use planning process of a roadless area found to have wilderness characteristics as described in Section 2(c) of the Wilderness Act of 1964.

wildfire: Unplanned human or naturally caused fires in wildlands.

wildland fire: Any fire, regardless of ignition source, that is burning outside a prescribed fire and any fire burning on public lands or threatening public land resources, where no fire prescription standards have been prepared.

wildland urban Interface (WUI): The area adjacent to an at-risk community that is identified in the community wildfire protection plan, or if there is no community wildfire protection plan in place, the area 0.5 mile from the boundary.

winter concentration area: That part of the winter range of a species where densities are at least 200% greater than the surrounding winter range density during the same period used to define winter range in the average five winters out of 10. (winter range is defined as that part of the overall range of a species where 90% of the individuals are located during the average five winters out of 10 from the first heavy snowfall to spring green-up, or during a site specific period of winter as defined for each data analysis unit).

winter range: A range, usually at lower elevation, used by migratory deer and elk during the winter months; usually better defined and smaller than summer ranges.

woody debris recruitment: The actions that cause trees, braches, sticks, and other wood to fall into streams and rivers and influence the flow and shape of the stream channels and subsequent aquatic habitat

Zoophankton: Minute primary animal consumers that feed directly on phytoplankton (minute living plants) in a body of water.

5.4 Keyword Index